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PIT & QUARRY

JANUARY 1983

Like the phoenix — can our industries regain their vigor?

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1982 REVIEW

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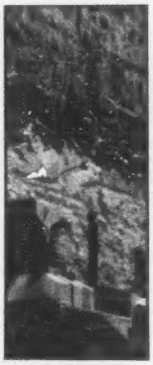

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AND NEXT MONTH

Focus features will review a variety of material handling systems.

ON THIS MONTH'S COVER

As discussed in our Review & Outlook section, pit and quarry industries will, hopefully, emulate the mythical phoenix and rise from the ashes during the coming year. Art by Janet Wilcox, art director.

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MEMBER

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Portland cement in the United States: production and project survey

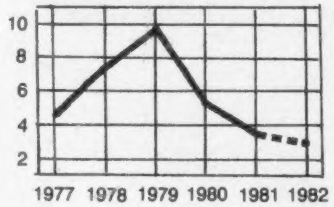
BY SID LEVINE

Cement production in the United States in 1982 dropped for the fourth successive year. Demand for cement in 1982 is estimated at about 6% less than that in 1981. Record high interest rates for construction markets received the major blame for the decline in cement demand.

Portland cement shipments by U.S. producers and others in the United States (including Puerto Rico) totaled 71.9 million short tons in 1981, a decrease of 5.5% from 1980 shipments and 15.3% from 1979.

Construction: The value of new construction put-in-place in the United States, in constant 1977 dollars, amounted to $155.8 billion in 1981, compared to $160.7 billion in 1980, and $179.3 billion in 1979.

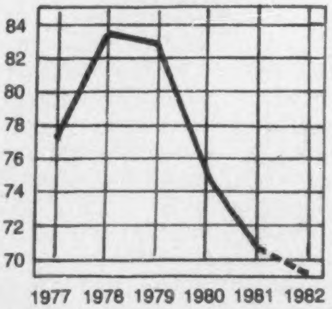
U.S. Imports of Hydraulic Cement Cement and Clinker for Consumption
(million short tons)



1977	4.038
1978	6.597
1979	9.413
1980	5.263
1981	3.997
1982 (est.)	3.0

Source: U.S. Bureau of Mines; Pit & Quarry estimate.

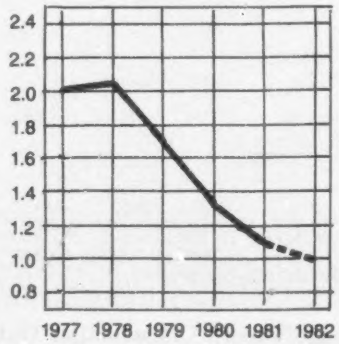
Portland Cement Shipped by Producers in the United States (includes Puerto Rico)
(million short tons)



1977	77.850
1978	83.849
1979	83.390
1980	74.675
1981	70.228
1982 (estim.)	67.6

Source: U.S. Bureau of Mines; Pit & Quarry estimate.

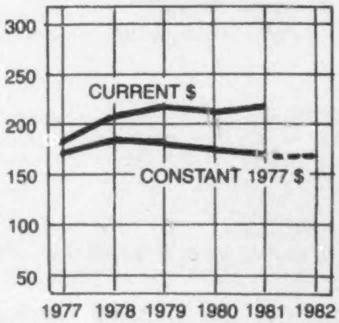
New Housing Starts
(in millions of units)



1977	2.002
1978	2.036
1979	1.760
1980	1.313
1981	1.100
1982 (est.)	1.0

Source: U.S. Dept. of Commerce; Pit & Quarry estimate

New Construction Put-in-place in the United States in Current and Constant (1977) Dollars
(billion dollars)



	Current	Constant
1977	$173.829	$173.395
1978	205.561	181.987
1979	230.781	179.265
1980	230.273	160.696
1981	237.037	155.834
1982 (est.)	—	143

Source: U.S. Dept. of Commerce; Pit & Quarry estimate

Hydraulic Cement in the United States:
(Source: U.S. Bureau of Mines)

Portland Cement (in million short tons)	1977	1978	1979	1980	1981
Clinker production:					
In states	70.650	74.065	74.805	68.315	66.614
Puerto Rico	1.337	1.390	1.338	1.433	1.101
Total	71.987	75.455	76.143	69.748	67.715
Portland cement production:					
In states	74.927	79.883	80.658	72.172	68.931
Puerto Rico	1.413	1.495	1.413	1.485	1.222
Total (a)	76.340	81.378	82.071	73.657	70.153
Portland cement shipped by producers in the United States:					
In states (a)	75.514	80.009	78.978	71.613	68.197
Foreign imports (b)	.969	2.398	3.006	1.580	.805
Puerto Rico	1.367	1.442	1.406	1.482	1.226
Total	77.850	83.649	83.390	74.675	70.228
Shipments by others (c)	.880	.989	1.470	1.387	1.673
Total U.S. shipments	78.730	84.838	84.860	76.062	71.901
U.S. imports for consumption of cement and cement clinker:					
Roman, portland & other hydraulic cement	2.394	3.589	4.664	3.232	2.654
Hydraulic cement clinker	1.613	2.968	4.668	1.917	1.226
White nonstaining portland cement	.031	.040	.081	.114	.117
Total	4.038	6.597	9.413	5.263	3.997
U.S. exports of hydraulic cement and cement clinker	239	.058	.151	.186	.303
Masonry Cement (in million short tons)					
U.S. production (d)	3.720	4.102	3.833	3.052	2.779
Shipped by producers in the U.S.	3.753	4.124	3.748	3.040	2.738
Foreign imports (e)	.011	.026	.014	.010	.008
Total	3.764	4.150	3.762	3.050	2.746
Shipments—by origin					
United States	3.753	4.124	3.749	3.044	2.738
Puerto Rico	—	—	—	—	—
Foreign Imports:					
Domestic producers	.011	.026	.014	.010	.008
Others (c)	.026	.025	.032	.035	.035
Total	3.790	4.175	3.795	3.089	2.781
Hydraulic Cement-Value (in billion dollars)					
Portland cement shipped by producers in the United States	$ 2.831	$ 3.413	$ 3.856	$ 3.800	$ 3.666
Masonry cement shipped by producers in the United States	.170	.210	.205	.190	.163
U.S. imports for consumption of hydraulic cement and cement clinker (customs value)	.094	.191	.302	.196	.151
U.S. exports of hydraulic cement and cement clinker	.023	.009	.015	.017	.032

(a) Includes cement produced by domestic producers from imported clinker (million tons):

1977	1978	1979	1980	1981
1.483	3.036	4.171	2.111	1.276

(b) Cement imported and distributed by domestic producers only
(c) Imported cementy distributed by Canadian cement manufacturers and other importers
(d) Includes masonry cement produced from:

(in million tons)	1977	1978	1979	1980	1981
Clinker	—	3.360	3.129	2.621	2.445
Cement	—	742	.704	.431	.334

(e) Masonry cement imported and distributed by domestic producers only

For 1982, the Portland Cement Association projected an 8.45% drop in new construction followed by a 3.12% rise in 1983.

Housing starts in 1982 were forecast to amount to 1 million units compared to 1.10 million in 1981, and then rise to about 1.35 million units in 1983. The "1983 Dodge/Sweet's Construction Outlook" (October 1982) predicts that 1983 construction contracts may reach $167.475 billion, compared to the estimated 1982 value of $149.125 billion and actual value of $150.189 billion in 1981. A detailed review and forecast for construction in the United States, prepared by Jim Kostka, Pit & Quarry's director of marketing and research, appears elsewhere in this issue.

Production: Clinker manufactured in kilns in the United States and Puerto Rico amounted to 67.715 million short tons in 1981, down 2.9% from 1980 and 13.4% below 1973's record output of 78.21 million tons. Finished portland cement ground from domestic and imported clinker totaled 70.153 million tons in 1981 and 73.657 million tons in 1980. U.S. masonry cement production amounted to 2.779 million short tons in 1981 and 3.052 million tons in 1980. In 1982, 44 companies operated 142 clinker manufacturing plants in 40 states; two companies in Puerto Rico operated two plants. Masonry cement was made in 100 plants in 1981.

Consumption and markets: Portland cement shipments from plants in the United States (including Puerto Rico) amounted to 70.228 million short tons in 1981. By type of customer and percentage, shipments were ready-mixed concrete, 68.9%; concrete products manufacturers, 12%; building materials dealers, 5.5%; highway contractors, 4.3%; other contractors, 6.9%; federal, state, and other government agencies, .4%; miscellaneous, including own use by producers, 2%.

Shipments by cement types in 1981 were general use and moderate heat (Types I and II), 89.06%; high early-strength (Type III), 3.66%; sulfate-resisting (Type IV), .28%; oil well, 4.66%; white, .47%; portland slag and portland pozzolan, .97%; expansive, .08%; miscellaneous (includes waterproof cement and low-heat Type IV), .82%. Cement consumption in the United States by Portland Cement Association regions is shown on a percentage basis in an accompanying table.

Imports and exports: U.S. imports for consumption of hydraulic cement and cement clinker in 1981 amounted to 3.997 million short tons, a 24% drop from 1980 and a 58% drop from 1979's record 9.413 million tons. The 1981 quantity was 5.6% of total U.S. shipments from plants as compared with the 11.3% for 1979 imports. For 1982, imports are expected to show a

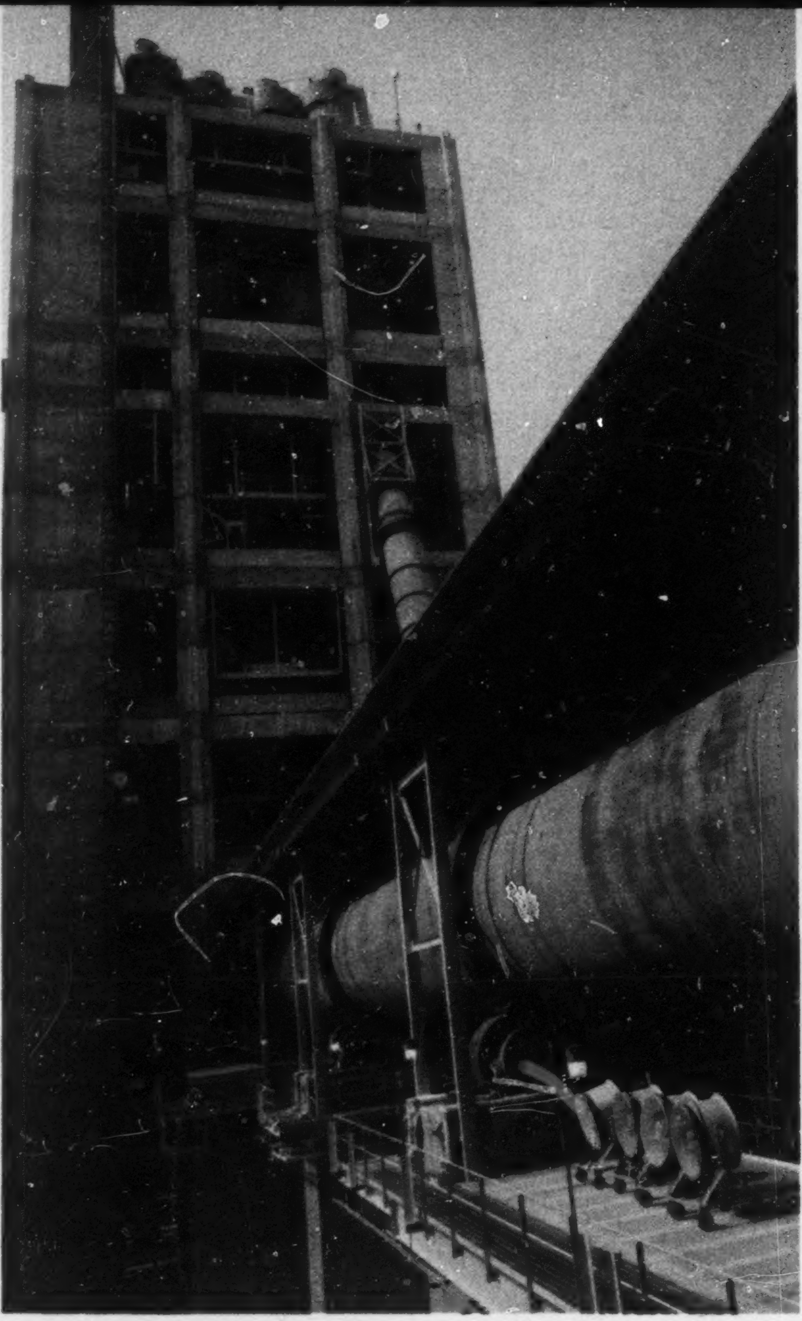
25% drop from 1981. Exports amounted to 303,000 short tons in 1981 and 186,000 tons in 1980.

Values and prices: The value of finished portland cement shipped by producers in the United States and Puerto Rico in 1981 amounted to $3.67 billion, compared with $3.80 billion in 1980. The average mill value (in bulk) was $52.50 per ton in 1981 and $50.89 in 1980. Prices in October 1982, as reported in *Engineering News-Record,* ranged from $51 per ton in Chicago to $78.50 per ton in Seattle.

The value of masonry cement produced in 1981 totaled $162.804 million compared to $189.438 million in 1980. The average mill value (in bulk) was $59.29 per ton in 1981 and $62.11 in 1980. October 1982 prices of cement mortar (in 70-lb. bags), as reported in *Engineering News-Record,* ranged from $2.55 per bag in Atlanta to $5.70 per bag in New York City.

Capacity and company changes: As reported in the Portland Cement Association's "Plant Information Summary," more than 9 million short tons of gross new annual clinker capacity (a record amount) was added in the United States in 1981. The retirement of 6.4 million tons of older capacity gave a net increase in total U.S. clinker capacity of 3 million tons, bringing total 1981 capacity to 89.5 million tons.

During 1981, 11 new kilns involving 11 cement plants came onstream, while 31 old kilns at 12 older plants were retired, as noted in the PCA summary. Of the shutdown units in 1981, 19 kilns were at nine plants that completely stopped production. Temporary and permanent plant closures took place in 1982 because of continued poor market conditions and uneconomic operating conditions. Production was temporarily suspended at several Ideal Basic plants; all kilns at National Gypsum's Alpena, Mich. plant were shut down temporarily at the end of April to reduce inventories; Northwestern States suspended manufacturing operations from March 31 to June 1; St. Lawrence Cement scheduled suspension of most production at its Joliette, Quebec plant for several months, starting in mid-November. Ideal Basic stopped gray and white ce-



Ideal Basic Industries, Inc. (Theodore, Ala.)—Rated at 1.5 million tpy, the "Cris Dobbins" plant (onstream in 1982) incorporates an Allis-Chalmers reinforced suspension preheater, precalciner, and 16′ × 280′ rotary kiln. *(Courtesy: Allis-Chalmers)*

U.S. Portland Cement Consumption By Portland Cement Association Regions
(in percent)

Region	1980	1981	1982 (estim.)
Eastern	16.82%	16.68%	17.54%
Great Lakes-Midwestern	15.00	13.97	13.69
Southeastern	17.74	17.99	16.62
North Central	5.52	5.15	5.08
Rocky Mountain-Northwestern	8.26	8.46	8.30
Pacific-Southwestern	14.31	13.74	13.23
South Central	22.35	24.01	25.54
	100.00	100.00	100.00
Total U.S. consumption (in million short tons)	74.255	70.020	65.0

Source: Portland Cement Association

ment production permanently at its Houston, Tex. plant, and Bessemer Cement Co. closed its Bessemer, Pa. plant.

Several plants changed hands in 1982, but there were no large-scale acquisitions or mergers as took place in 1980 and 1981 (the Genstar/Flintkote and Canada Cement Lafarge/General Portland mergers). Lone Star purchased Marquette Co. (the cement-producing subsidiary of Gulf+Western Industries) and Cyprus Hawaiian Cement Corp. (a unit of Standard Oil Co.-Indiana) plant in Oahu, Hawaii in 1982. Marquette's six plants are rated at 3.1 million stpy capacity and Cyprus Hawaiian's capacity is 270,000 tpy.

Cement plant start-ups, modernizations and expansions in 1981 and 1982, and projected installations are listed in the following annual Pit & Quarry survey.

Alamo Cement Co.

- Bexar County, Texas (adjacent San Antonio metropolitan area): New 1-million tpy plant onstream in 1981. Major equipment and process engineering provided by Polysius Corp. Equipment includes Polysius roller mill for raw grinding; Polysius rotary kiln with Prepol preheater and alkali bypass; Claudius-Peters grate cooler; Polysius roller mill for coke and coal grinding; heat exchanger for recirculating vent air back to undergrate. Civil and structural engineering provided by Consultec of Mississauga, Ont. (See Pit & Quarry, December 1982.)

Ash Grove Chemical Co.

- Louisville, Neb.: Adding a 600,000 tpy dry process line. Current plant consists of one dry process and three wet process production lines rated at 750,000 short tons per year. Humboldt Wedag is supplying and erecting this new system on a turnkey basis. Included in the system will be an 1,800 tpd suspension Pyroclon preheater unit with a 12.5×164 ft. rotary kiln and a grate cooler. Digital process control and programmable motor control is used. Holmes & Narver, Inc. provided engineering and construction services. Bendy Engineering provided engineering and construction management for clinker storage, rail unloading, services building. Scheduled onstream in 1982.

Atlantic Cement Co., Inc.

- Sparrows Point, Md.: Slag cement plant rated at 800,000 tpy onstream in 1982. Slag from Bethlehem Steel's Sparrows Point blast furnace is granulated and ground. Design-and-construct contract handled by Davy McKee Corp.

California Portland Cement Co.

- Mojave, Calif.: Addition of a 1 million tpy plant to the existing 1.1 million tpy facility. Raymond Kaiser Engineers supplied engineering, procurement, and construction management services. Equipment included Fuller IHI precalciner; Fuller four-stage suspension preheater with flash furnace and 13½ ft.×225 ft. rotary kiln section; Fuller grate clinker cooler; Allis-Chalmers 250 tph, 2,000 hp roller mill for raw grinding; Humboldt Wedag 1,500 tph impact crusher; Leeds & Northrup dual computer. Coal is supplied for the plant by the company's Soldier Creek Coal division near Price, Utah. Onstream in 1982.

Columbia Cement Corp.

- Bellingham, Wash.: First phase of a $75 million plant expansion has begun. Plans include a new finish mill, new clinker facilities capable of handling clinker shipped in by water and rail, new cement storage silos, and new fuel handling equipment. Plant capacity will be increased to 750,000 tpy of finished cement in this first phase, estimated to cost $15 million. The $60 million second phase will include one kiln rated at 700,000 tpy of clinker, a new raw mill, and modernization of all other plant facilities.
- Zanesville, Ohio: Will undertake a $3.34 million equipment modernization program.

General Portland, Inc.

- New Braunfels, Tex. (Balcones plant): New 925,000 tpy, $80 million dry process preheater plant, using coal as fuel, onstream in 1981. Equipment supplied includes Polysius 15 ft.×241 ft., 2,750 tpd rotary kiln with Dopol heater and Prepol precalciner; 237 tph roller mill; two 96 tph finish mills; C-E Raymond coal mill; Fuller grate clinker cooler; Mikropul dust collectors. Polysius Corp. provided engineering and supplied major equipment. Dyckerhoff Zementwerke AG, West Germany, acted as consultant on design and startup. (See Pit & Quarry, July 1981, pp. 68-75.)

Genstar Cement & Lime Co.

- Redding, Calif.: A $40 million expansion and modernization program, completed in 1981, has increased capacity from 290,000 to 600,000 tpy. Equipment includes F.L. Smidth precalciner/preheater system with 4.35×66m rotary kiln section and planetary cooler; 150 tpd raw roller mill; Foxboro control units. Engineering, procurement, and construction management were handled by Raymond Kaiser Engineers (See Pit & Quarry, July 1981, pp. 110-114.)

Ideal Basic Industries, Inc.

- Theodore, Ala.: New 1.5 million tpy "Cris Dobbins" dry process (precalciner) plant onstream in 1982. Equipment includes Allis-Chalmers 4,660 tpd reinforced suspension preheater system, consisting of a 260 ft. high suspension preheater tower, a 16 ft.×280 ft. rotary kiln, and a stoker-type clinker cooler; a Stamler feeder-breaker in the quarry; two Raymond coal mills; 65 Mikro-Pulsaire dust collectors; two F.L. Smidth Unidan finish mills with 6,500 hp. motors; four F.L. Smidth cement coolers. Brown & Root designed and built this plant. (See Pit & Quarry, July 1982, pp. 72-74.)
- Boettcher, Colo.: Onstream in 1981, new grate preheater kiln replaced two 50-year-old kilns to increase capacity from 115,000 tpy to 425,000 tpy. The preheater is specially designed to use the kerogen in the kerogen-bearing limestone available in the quarry deposit. Chalmers provided the ACL system, including: 12 ft. 2 in. wide×112½ ft. long traveling grate; 14 ft.×15 ft.×204 ft. rotary kiln; 1,400 tpd roller mill; type MPS 3450, 110 tph roller mill; stoker cooler; 15 ft. diameter pelletizer pan.

Kaiser Cement Corp.

- Permanente, Calif.: In a $78.5 million modernization program, a single preheater-precalciner

Martin Marietta Corp. (Davenport, Iowa)—New 850,000 tpy dry process plant, onstream in 1982. Pyroprocessing equipment includes F.L. Smidth preheater/precalcining unit with 14 ft. × 200 ft. rotary kiln. *(Courtesy: Raymond Kaiser Engineers)*

equipped, dry process kiln replaced six oil-fired, wet process kilns. The dry process kiln burns coal as well as other fuels. Lafarge Consultants Ltd. handled engineering design services, procurement assistance, and start-up responsibility. The rebuilt plant went on line in 1981. The designed plant capacity is 1.6 million tpy. The equipment includes an Allis Chalmers 5,000 tpd reinforced suspension preheater with a 16 ft. × 250 ft. rotary kiln section; two Raymond coal mills; two 15 ft. × 53½ ft. Humboldt Wedag center discharge raw mills, each equipped with a 5,000 hp single pinion gear drive (preheater waste gases are used for drying the mills).

- Lucerne Valley, Calif.: (Cushenbury plant) construction is under way for a $135 million modernization and expansion program for this 1.015 million tpy wet plant. A computer-controlled, preheater/precalciner kiln system will replace the wet process. Capacity is slated to increase to 1.5 million tons. Operation is scheduled for 1983. Equipment includes 4,500-tpd Allis-Chalmers RSP tower, 300 ft. high, and a 16 ft. × 250 ft. kiln; Claudius-Peters recuperator/cooler; 7,000-hp FLS center discharge raw mill; 4,000 hp, 13 ft. × 42 ft. Compeb Allis-Chalmers finish mill; baghouse for kiln and mill; digital process and motor control. Raymond Kaiser Engineers is providing engineering, equipment procurement, and construction management services.

Las Vegas Portland Cement Co.

- Jean, Nev. (25 miles south of Las Vegas): Polysius has prepared feasibility study for a single kiln, 2 million tpy plant with an estimated cost of $221 million.

Lehigh Portland Cement Co.

- Alsen, N.Y.: Planning new 750,000 tpy plant; scheduled onstream in 1984.

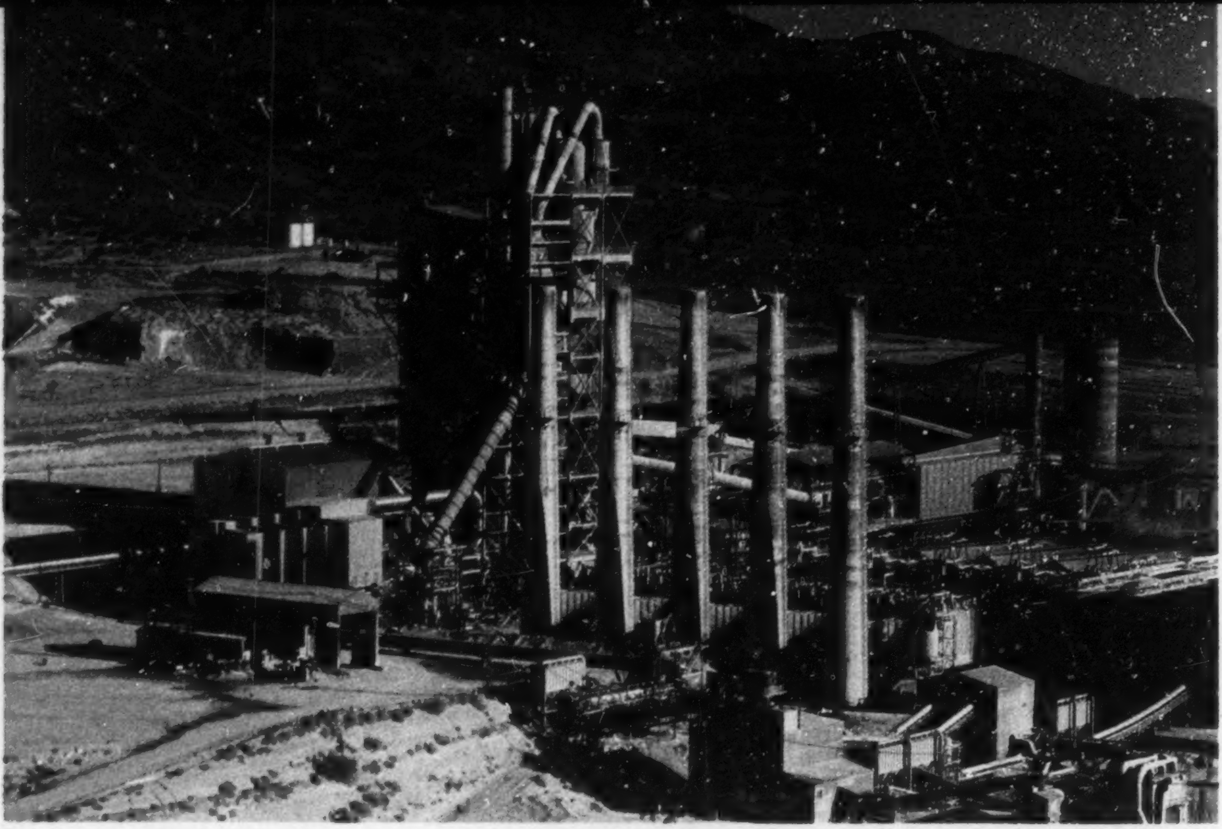
Lone Star Industries, Inc. (Cement & Construction Materials Group)

- Santa Cruz, Calif.: Expansion and modernization. Onstream, 1981. Capacity increased from 395,000 to 750,000 tpy. Equipment supplied includes F.L. Smidth four-stage preheater precalciner unit with 13 ft. × 184 ft. rotary kiln section and Folax grate clinker cooler; raw roller mill; homogenizing/kiln feed silos; new cement grinding mill; additional electrostatic precipitators; C-E Raymond bowl mill; 18-ft. diameter air separator. Engineering planning was carried out by Bendy Engineering Co. and SPCM, Inc.
- Concrete, Wash.: Lafarge Consultants Ltd., Montreal, Que., has been awarded a contract to provide engineering services for the project definition phase of a new 750,000 tpy cement plant near the town of Concrete, Wash. (on the site of an existing Lone Star quarry).

This phase will involve the design and capital cost estimates of crushing, raw material storage, raw milling, pyroprocessing, and clinker handling facilities including the necessary auxiliary units for a continuous process, fully automated, and computer-controlled operation.

Also included in the project definition are a new shipping facility in the town of Concrete, as well as new rail siding and unloading facilities at Lone Star's Seattle plant where clinker from the new plant will be ground and processed into cement.

- Cape Girardeau, Mo.: New 1.1 million tpy dry process plant at the same location. Raymond Kaiser Engineers provided engineering, procurement, and construction services. On line in 1981. Equipment supplied includes Allis-Chalmers' four-stage, reinforced suspension preheater with a 14.5 ft. × 235 ft. rotary kiln section; an Allis-Chalmers stoker-type grate



California Portland Cement Co. (Mojave, Calif.)—Added 1 million tpy capacity in 1982 with Fuller IHI system, including precalciner, four-stage suspension preheater/flash furnace, and 13½ ft. × 225 ft. rotary kiln. *(Courtesy: Raymond Kaiser Engineers)*

clinker cooler; two Allis-Chalmers 13 ft. × 52 ft., 4,500 hp Compeb finish mills; C-E Raymond raw roller mill rated at 250 tph and driven by a 3,000 hp motor; two Raymond 21-ft. diameter air separators for the finish mills; two C-E Raymond bowl-type coal mills; Envirotech-Buell electrostatic precipitator; baghouses; and cyclone dust collectors. Instrumentation, a combination of Eagle Signal, G & W Manufacturing Co., and Swanson Engineering Co. equipment, incorporates an online computer system consisting of three CRTs with a plant display panel board.

Martin Marietta Corp.

- Buffalo, Iowa (near Davenport): New 850,000 tpy dry process coal-fired plant onstream in 1981. Equipment supplied includes F.L. Smidth preheater/precalciner kiln with 14 ft. × 200 ft. rotary kiln section and a 924S Folax grate cooler; Allis-Chalmers multi-compartment rotary Compeb mill, 15 ft. × 53 ft., 7,000 hp.; Allis-Chalmers 230-tph roller mill, 1,500 hp. Raymond Kaiser Engineers provided engineering and construction management services. (See Pit & Quarry, July 1982, pp. 94-104.)
- Lyons, Colo.: Long-kiln, dry process plant conversion to flash calcining system; contract with Fuller Co. The 14¼ ft. × 17 ft. × 490 ft. rotary kiln was cut to 14¼ ft. × 245 ft. A Fuller SF 135 suspension flash calciner, with a modified Stage IV cyclone, is used to preheat and partially calcine the raw materials. The plant's existing direct coal-fired system has been converted to a semi-direct system to permit use of pulverized coal for the kiln and the flash calciner. After the conversion, rated capacity became 1,250 tpd. Kerogens in the shale portion of the raw materials will be burned off in the flash calciner. Start-up in 1981. (See Pit & Quarry, July 1981, pp. 82-87.)
- Leamington, Utah: New 650,000-tpy plant onstream in 1981. Fuller Co. provided design, engineering, and equipment for the plant. S. & W. Construction built the plant.

Fuller equipment includes 1,800 tpd suspension preheater/flash calciner/coal fired 12½ ft. × 175 ft. rotary kiln; Fuller-Loesche roller mill, 160 tph; two Airmerge blending systems, rated at 3,000 tons each; FK pump for raw mix; coal roller mill; inclined grate cooler; heat exchanger; Plenum-Pulse dust collector; and a 13½ ft. × 47 ft. finish mill (See Pit & Quarry, July 1982, pp. 52-60.)

Monolith Portland Cement Co.

- Monolith, Calif.: Monolith plans on doubling the plant's capacity to 1 million tons per year. The kiln that will be installed, 15 ft. × 17½ ft. × 520 ft. long with clinker cooler and coal mill, has a rated capacity of 500,000 tpy. Scheduled onstream in 1982.
- Laramie, Wyo.: Increasing capacity from 200,000 tpy to 500,000 tpy with addition of a new F.L. Smidth 12 ft. × 13½ ft. × 450 ft. wet process rotary kiln rated at 900 tpd; also included are a clinker cooler, coal mill, finish mill, pollution control equipment, and associated equipment. Onstream in 1982.

Moore McCormack Cement, Inc.

- Brooksville, Fla.: A $68 million expansion program will double plant production to 1.2 million tpy. The company is adding a second coal-fired kiln and is increasing grinding and storage capabilities. New kiln to be operational in 1982. Polysius will supply the equipment including Gepol preheater/kiln rated at 1,650 tpd; Airswept raw mill, 153 tph capacity; two-compartment finish mill rated at 100 tph; and related equipment and instrumentation. Fuller Co. will supply two fabric filter, dust-collection systems.

Puerto Rican Cement Co. Inc.

- Ponce, Puerto Rico: Raymond Kaiser Engineers is providing engineering, detail design, and procurement assistance on an assignment to convert the plant from oil to coal. The three largest of the plant's six wet process kilns will be converted to dual-firing capacity with coal as primary fuel and oil as backup. The three kilns to be converted produce about 75% of the plant's total annual output of 1.2 million tons of finished cement. Project also includes a pneumatic pump system for coal handling and a milling facility with a 40 tph capacity. Conversion will be complete in mid-1983.

Southwestern Portland Cement Co.

- Victorville, Calif.: Humboldt-Wedag has received a turnkey award for $100 million modernization and expansion. Capacity to be increased from 1.1 million tpy to 1.4 million tpy. Equipment addition includes an 800,000 tpy preheater precalciner kiln and retirement of 500,000 tpy wet process capacity. Holderbank Consulting will assist in supervision of project execution.

Texas Cement Co.

- Buda, Texas: Expansion adding 564,000 tpy for final capacity of about 1.13 million tpy. Scheduled onstream in 1983. Fuller Co. awarded contract of $9 million for: Fuller-Loesche roller mill; 3,500 hp finish mill system; baghouse dust collector; two 11 ft. × 16 ft. material coolers; 20 ft. diam. air separator; preheater-flash calciner; conveying systems; and cement truck handling system.

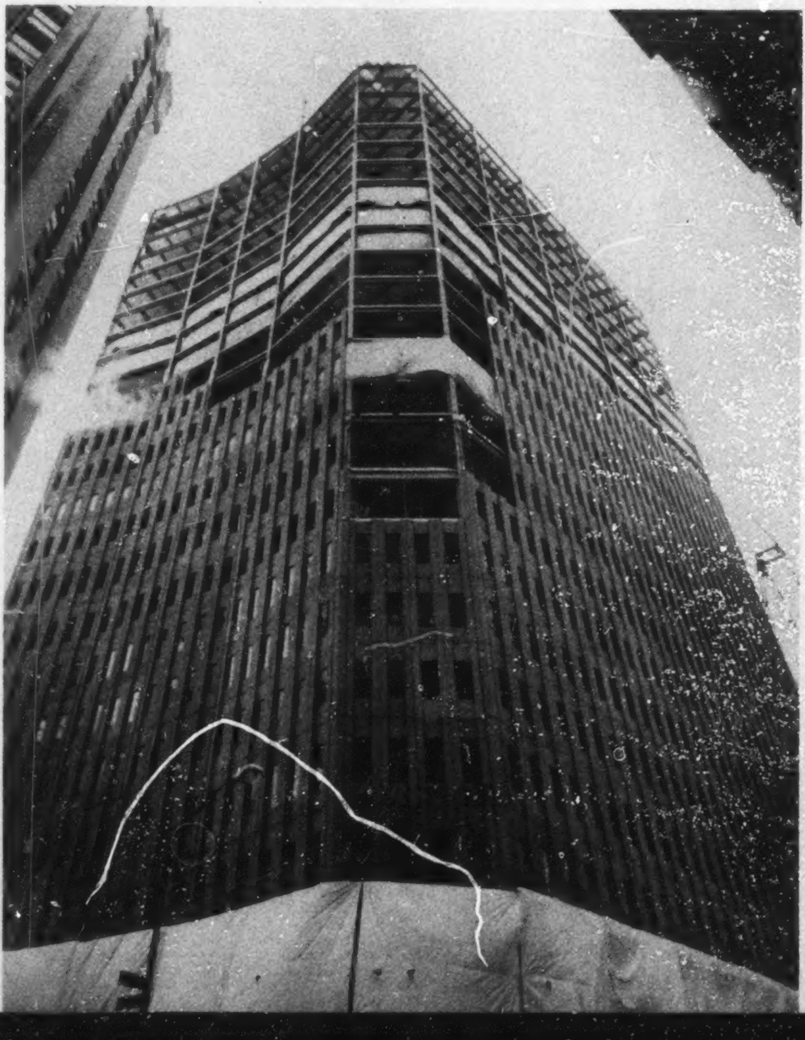
Texas Industries, Inc.

- Hunter, Tex.: New 550,000 tpy, $50 million dry process plant onstream in 1981. Equipment includes Polysius 12 ft. × 284 ft. 2,000 tpd rotary kiln with Dopol preheater and Prepol AS precalciner; 165 tph roller mill; homogenizing systems; and central control panel and instrumentation.

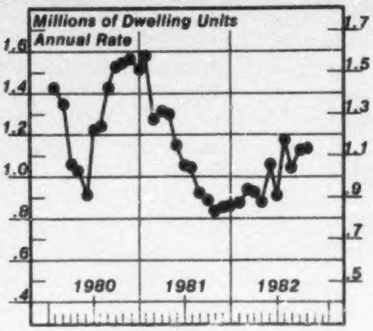
1983 Construction viewed with restrained optimism

BY JIM KOSTKA

At this time last year, most economists felt we would be climbing out of the recession by mid-1982. The prime rate had started to drop from its 20.5% level in September 1981 and continued to decline throughout the remainder of the year. This, it was felt, would stimulate construction. Unfortunately, such was not the case. Although the cost of borrowing money was becoming more attractive by the day, the economic condition of the country was such that few people were willing to borrow the money to initiate construction projects. Most people had developed a "wait and see"

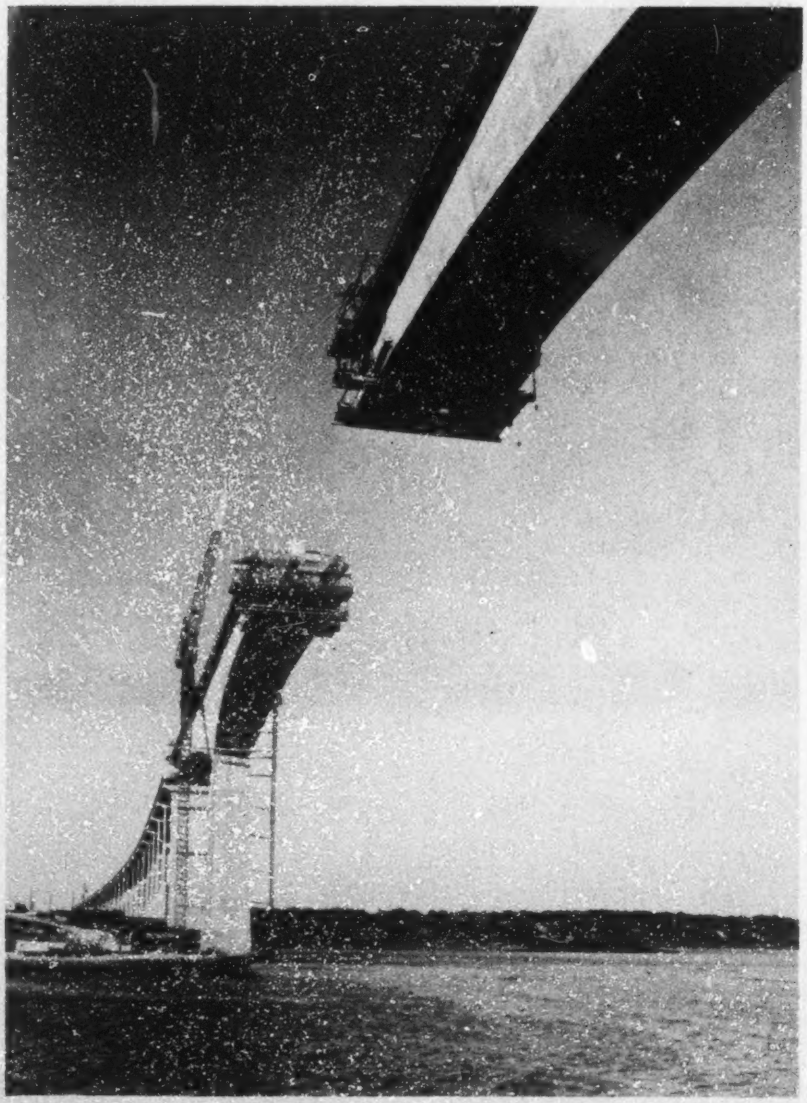


Housing Starts



attitude. With interest rates on their way down, people who were potential investors in construction were willing to wait a while longer to see just how far interest rates actually would drop.

Currently, the prospects for construction are viewed with mild optimism. Falling interest rates finally have stimulated the sale of single-family homes. In September 1982, this sector enjoyed a sharp increase of 23.7%. The growing demand for housing is expected to continue during the remainder of 1982 and throughout 1983. There is enough pent-up demand for housing resulting from more than 2 years of recession to give this sector a steady growth potential for at least the next 4 or 5 years.



Highway and bridge construction in 1983 will total $12 billion, the same as in 1982.

Economists who specialize in forecasting the activities of the construction industry agree that the prospects for construction, and housing in particular, are good. Robert Roy of the Portland Cement Association indicates that total physical construction in the United States will be up about 3% in 1983. George Christie, who provides the information for the 1983 Dodge/Sweet's Construction Outlook, says the *value* of total U.S. construction will be about $167.5 billion—a 12% increase over 1982. Making an adjustment for an annual inflation rate of around 6%, the actual rate of physical construction should show an increase of around 5%. The forecast by George Christie appears to be based on the assumption that construction will develop an upward momentum somewhat earlier in the year than Robert Roy of the Portland Cement Association feels it will and, as a consequence, he expects construction to show a greater total gain in 1983.

Housing

Housing, the backbone of the construction industry, is counted upon to get things rolling late in 1982 and throughout 1983. Construction of one family houses, which totaled about 615,000 units in 1982, is expected to jump a substantial 34% with the erection of 825,000 units in 1983. Multifamily housing also should show a healthy gain, going from 410,000 units in 1982 to 500,000 units in 1983—an increase of 22%. The combined housing markets will total about 1.33 million units, representing a gain of 300,000 units over the previous year. Expressed in percentages, the total housing industry should be up approximately 29%.

Condominiums and one family houses are expected to show the strongest gains in 1983 (in that order) as falling mortgage rates let more people with buying potential get into the market. Apartment construction also should show a gain, but it will be only about one-half as large as the gain for condominiums and one family houses.

Total floor area for dwelling unit construction in 1983 will increase proportionately to the number of units built. New construction of one family houses will have a total of 1,300 million sq. ft., up 34% from the previous year. The floor area for multi-family housing will increase an anticipated 27% with a total of 520 million sq. ft. Nonhousekeeping residential floor area, however, is expected to decline 8% in 1983 with a total of 55 million sq. ft.

Nonresidential building

Historically, there has been a lag between a rising economy and residential building construction. One of the reasons is that, if nonresidential building is to improve, the environment of a strong economy is needed. After a recession, it takes time to gain economic strength; it appears an improvement in nonresidential building construction will not be manifested for at least another year.

Another reason for the nonresidential building lag is the heterogeneous makeup of this market. Composed of half a dozen or more individual building types, each with its own cycle, the market is a rather distorted composite of several individual turning points. This means that, as nonresidential building begins to recover, its turnaround will take place sequentially, not all at once.

Office buildings

During the early part of the recession, office building construction was the only bright spot in the total construction picture. The boom in office building, which has provided welcome support to an otherwise weakening nonresidential market for 2 years, is due for a major correction. There is now an excessive amount of office space, and it will be at least several years before there will be enough occupants to fill the surplus. The speed at which this takes place depends a great deal upon the speed of the economic recovery.

The office boom was created by an explosive surge in the white collar labor force which reached its peak before 1980 and since has been diminishing. This factor has been compounded by the deep recession and rising unemployment occurring just at the time when office buildings, started a year and a half ago, became available for occupancy. The oversupply of space will be a heavy drag on the recovery of the nonresidential

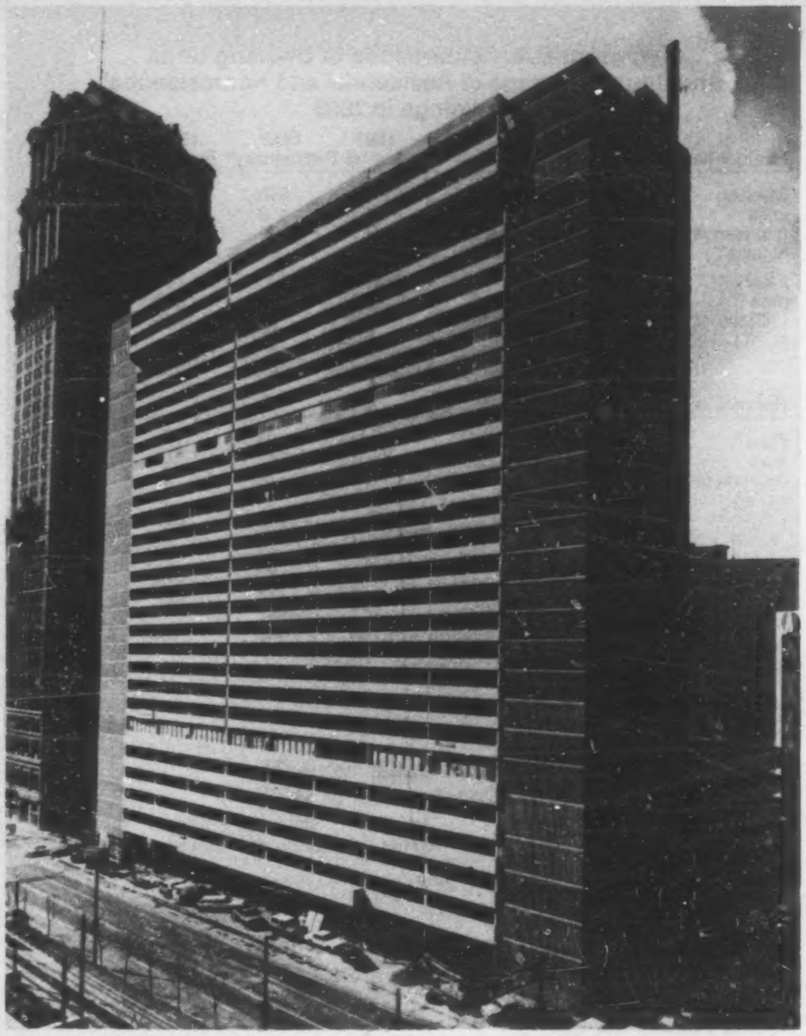
Estimated U.S. Construction of Dwelling Units And Square Footage of Residential and Nonresidential Buildings in 1983

Residential buildings		1981 Actual	1982 Preliminary*	1983 Forecast	% Change 1983/82
Dwelling units (thousands of units**)	One-family houses	674	615	825	+34
	Multifamily housing	450	410	500	+22
	Total housekeeping residential	1,124	1,025	1,325	+29
Floor area (millions of sq. ft.)	One-family houses	1,079	970	1,300	+34
	Multifamily housing	478	410	520	+27
	Nonhousekeeping residential	60	60	55	− 8
	Total residential buildings	**1,617**	**1,440**	**1,875**	**+30**
Nonresidential buildings					
Floor area (millions of sq. ft.)	Office buildings	317	253	175	−31
	Stores & other commercial	404	302	340	+13
	Manufacturing buildings	185	115	125	+ 9
	Total commercial & manufacturing	906	670	640	− 4
	Educational	74	74	75	+ 1
	Hospital & health	60	63	65	+ 3
	Other nonresidential buildings	126	108	110	+ 2
	Total institutional & other	260	245	250	+ 2
	Total nonresidential buildings	**1,166**	**915**	**890**	**− 3**

**Eight month actual; four months estimated.*
***F.W. Dodge basis.*

Estimated Dollar Value Of U.S. Construction in 1983

Residential buildings		1981 Actual	1982 Preliminary	1983 Forecast	% Change 1983/82
Contract value (millions of dollars)	One-family houses	$ 38,363	$ 36,850	$ 53,100	+44
	Multifamily housing	17,821	16,800	22,900	+36
	Nonhousekeeping residential	3,879	4,325	4,100	− 5
	Total residential buildings	**$ 60,063**	**$ 57,975**	**$ 80,100**	**+38**
Nonresidential buildings					
Contract value (millions of dollars)	Office buildings	$ 19,268	$ 16,925	$ 12,800	−24
	Stores & other commercial	11,733	10,250	12,200	+19
	Manufacturing buildings	7,530	8,900	6,750	−24
	Total commercial & manufacturing	$ 38,531	$ 36,075	$ 31,750	−12
	Educational	$ 5,819	$ 6,125	$ 6,650	+ 9
	Hospital & health	6,218	6,850	7,575	+11
	Other nonresidential buildings	7,681	7,500	8,100	+ 8
	Total institutional & other	$ 19,718	$ 20,475	$ 22,325	+ 9
	Total nonresidential buildings	**$ 58,249**	**$ 56,550**	**$ 54,075**	**− 4**
Nonbuilding construction					
Contract value (millions of dollars)	Highways & bridges	$ 11,126	$ 12,000	$ 12,000	—
	Sewer & water	7,677	7,250	6,750	− 7
	Other public works	5,891	6,350	6,050	− 5
	Total public works	$ 24,694	$ 25,600	$ 24,800	− 3
	Utilities	$ 7,183	$ 9,000	$ 8,500	− 6
	Total nonbuilding construction	**$ 31,877**	**$ 34,600**	**$ 33,300**	**− 4**
All construction					
Contract value (millions of dollars)	**Total construction**	**$150,189**	**$149,125**	**$167,475**	**+12**
	Dodge Index (1977 = 100)	107	107	120	



A jump of 36% in the value of multifamily housing is anticipated in 1983 when its total reaches $22.9 billion.

building market in 1983 and in 1984 as well. As a result, the value of office building construction should experience a 24% drop in 1983 with a volume of $12,800 million.

Stores, other commercial buildings

There is a close correlation between stores and housing. As people build homes, stores also have to be built to supply food and merchandise. It's a simple case of one type of construction stimulating another.

Contracting for stores and shopping centers has been in almost steady decline since early 1979. Now that housing construction has bottomed out and is on the way up, stores and other commercial buildings are certain to follow a parallel path. In 1982, this segment accounted for $10,250 million worth of construction. A healthy gain of 19% is anticipated for this category in 1983 when its total should reach the $12,200 million level.

Construction of warehouse space has been growing relative to square footage of store space over the past decade, suggesting more intensive usage of selling space. This type of construction follows a regular cycle. First the stores are constructed, then warehouse construction follows soon afterward. Since the mid-1970s, the cumulative total of warehouse construction has matched the square footage for store space on a one-for-one basis.

Manufacturing buildings

High unemployment means there is little need to expand or build new manufacturing facilities. In all probability, the value of manufacturing building construction will drop close to 24% in 1983 with a volume of $6,750 million. This sector of the construction market isn't expected to show any marked improvement until unemployment drops well below the 12% level that now exists. Not until such major industries as automobile and steel begin to recover economically, can we expect industrial building construction to bounce back.

Institutional buildings

The withdrawal of federal financial support has tended to curtail severely institutional construction. Falling school enrollment has contributed to the decline. Instead of schools being built, quite a few are being closed. Institutional building construction, as a total, should show about a 9% increase in value, but the floor area will be only 2% higher in 1983 than it was in 1982.

Contributing to the 1983 floor space gain will be a 1% increase for educational facilities, a 3% rise for hospital and health structure, and a 2% increase for all other nonresidential buildings.

Public works

Public works will be last among the three major construction segments to adjust to the Reagan Administration's redirection of economic priorities. The consequences of the proposed transfer of responsibility from federal to local governments for all but a few functions already can be seen in the recent decline of public works construction. With federal programs currently funded at about 85% of authorization, and state and local governments unable to make up the difference, total contracting of public works construction has declined 15% since 1979. After adjustment for inflation, the actual physical construction of public works has fallen about 30%. Funding of federal programs will continue to be reduced for the next several years; thus, the direction this type of construction takes will be totally in the hands of state and local governments.

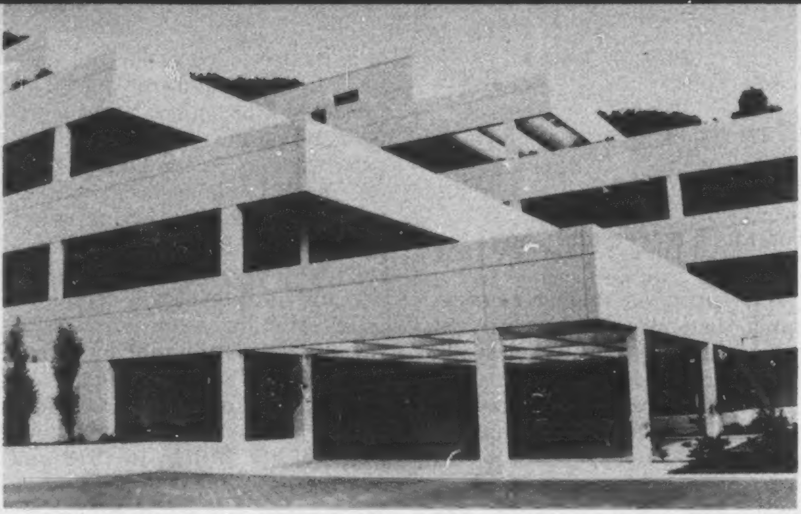
In 1983, highway and bridge construction, although badly needed, will show no gain from the $12,000 million expenditure in 1982. Sewer and water construction will do even worse by dropping from 1982's $7,250 million to $6,750 million in 1983, a decline of 7%. Other public works construction seems destined to suffer a similar fate with a forecasted drop of 5%, going from $6,350 million in 1982 to $6,050 million in 1983.

Utilities

This category is made up of only a few, but very large, construction projects. As an example, in 1982, a total of 12 projects—three pipelines and nine electric power plants—accounted for 80% of the year's estimated total of $9 billion of utility construction.

Construction in this category is going to fall an anticipated 6% in 1983 when the total reaches $8.5 billion. Contributing to the 1983 construction activity will be nine electric utilities that are likely to break ground. Three are located in Texas; however, no major pipeline construction is scheduled for 1983.

Because of the size of the projects involved, the addition or deferment of just one project could cause a substantial change in the numbers when final 1983 figures for this type of construction are tabulated. ●



Office building construction will be down 24% in 1983, to $12,000 million, due to excessive capacity and unemployment.

Views from national association leaders:

CEMENT: "some improvement in 1983"

Richard E. Reuss
President
Portland Cement Association

At an estimated 65 million tons, U.S. cement use in 1982 was at the lowest level since 1962. Shipments fell about 6% from 1981 and were 22% below 1973, the industry's best year. Some key indicators in the closing weeks of 1982 suggest that recovery—however modest—may occur in 1983. PCA market and economic researchers are projecting 1983 U.S. cement consumption at 69 million tons, which would amount to a 6% gain from 1982, but still well under the 78 million tpy average annual consumption of the 1970s.

Sharper increases, however, are projected for later years as the economic recovery pumps new life into depressed construction markets, particularly residential and related commercial building. For the next 5 years, PCA forecasters estimate cement consumption as follows:

		Forecast				
Region	1982	1983	1984	1985	1986	1987
Eastern	11,400	12,000	12,800	13,000	12,500	12,000
Great Lakes-Midwestern	8,900	9,800	11,300	12,000	12,500	11,500
Southeastern	10,800	11,300	12,800	13,600	14,000	14,000
North Central	3,300	3,600	4,000	4,500	5,000	5,500
Rocky Mtn.-Northwest	5,400	5,800	6,400	7,400	8,000	8,500
Pacific-Southwest	8,600	9,100	10,400	12,000	12,500	13,000
South Central	16,600	17,400	18,800	20,000	20,500	20,500
Total	65,000	69,000	76,500	82,500	85,000	85,000

Source: PCA Market and Economic Research

	Millions of Tons
1982	65.0
1983	69.0
1984	76.5
1985	82.5
1986	85.0
1987	85.0

Economic and construction outlook

If recovery is in fact close at hand, economic growth in the next few years likely will be relatively slow by historical standards. Construction-related capital investment by industry will be impeded by low profits and high debt resulting from the recession. Housing starts likely will not attain the 2 million annual level achieved in previous recoveries. In short, the construction industry has been damaged severely by the recession, and renewed growth will be slow and difficult. Dun and Bradstreet reports that business failures among building contractors reached a new high in 1980, increased another 50% in 1981, and rose an additional 36% in the first three quarters of 1982.

As in all business cycles, economic recovery finally does come. Home building usually turns up before other construction markets. Housing starts and permits have risen since late 1981, and other construction indicators have turned upward beginning in the first quarter of 1982. Although any reversal in the decline in interest rates could curtail the expansion, we believe the construction recovery has started and will continue, at a moderate pace, for the next several years. Following are PCA's projections for major sectors of private and public construction:

Residential: While housing will not reach previous boom proportions, sizable percentage gains are projected for 1983 and 1984. Housing starts are forecast to peak at about 1.8 million in 1985 compared to an estimated 1 million in 1982. As measured by annual dollar volume (stated in 1977 dollars), a 1985-86 peak of $63 billion is projected, compared with previous highs of $66 billion in 1978 and $73 billion in 1973.

Industrial building: Factory construction is projected to decline 2% in real terms in 1982 and another 9% in 1983, with increases expected in later years. The much-needed reindustrialization of America is likely to be delayed while business attempts to mend the damage suffered during the current recession; that damage includes high debt, weak profits, and low capacity utilization.

Office building: The office market has been strong over the past 3 years, especially in large cities in the South and West. But vacancy rates are rising, and the boom probably has ended in many areas. However, office construction should remain a growth market in the 1980s, gaining its strength from the migration of employment from manufacturing to services and from the Snow Belt to the Sun Belt.

Highways and streets: Paving has been on the decline since the peak years of the Interstate program of the mid-1960s. Now, with the nation's roads in great disrepair, many states and municipalities have been forced to increase spending for repair, maintenance, and reconstruction as well as new construction.

The federal excise tax on gasoline has not been increased for more than 20 years nor have fuel taxes in most states kept pace with highway needs. Increased federal and state tax levies are a likely source of badly needed additional funds for highways, streets, and bridges in the 1980s.

Other public construction: This category consists of sewer systems, water supply facilities, and other open construction. The critical needs in this area are universally recognized, but political considerations have delayed necessary funding of new and upgraded facilities. We believe public pressure will result in additional funding for these critical needs in the 1980s.

Outlook for cement

Overall, PCA forecasters are projecting a 20 million tpy increase in cement consumption in the 1980s—from 1982's depressed 65 million tons to 85 million tons in 1986 and 1987. The next peak in shipments will exceed every previous year except 1973. On a regional basis, cement consumption is projected in the table that appears on pg. 61.

CRUSHED STONE: Increased activity in 83's second half

William L. Carter
President
National Crushed Stone Association

Based on phone surveys of a good cross section of member producers and state associations, NCSA is forecasting 1983 crushed stone production at between 840 and 870 million tons, up from the U.S. Bureau of Mines' 1982 "estimate" in December '82 of between 820 and 840 million tons. (1981 production was 873 million per BuMines.)

The last half of 1983 should see increased construction activity, especially if there is approval in the 1982 lame duck Congressional Session of the proposed 5¢ increase in the federal gas tax; rebuilding the nation's infrastructure—highways, bridges, plus water and sewer systems—will result in increased use of crushed stone if this program develops. Other major factors such as the federal deficit, interest rates, unemployment, oil prices, etc. will be critical to the anticipated recovery.

The number of crushed stone companies and quarries continues to decline due to high capital and operating costs and cost of environmental controls. 1983 will see practical and economical federal regulations on air and water pollution controls, resulting from extensive industry and NCSA efforts.

LIMESTONE: outlook brightens

James H. Williams
President
National Limestone Institute

The 1983 outlook probably is brighter for our industry than it has been for a number of years. Lower rates of interest are helping to strengthen the economic outlook for virtually all industries, but, for the construction industry in particular, lower rates of interest *and* inflation will trigger our recovery through new construction and an expanded housing market.

The very best news, however, is that of an increased gasoline tax. As I write this, there appears to be good reason to believe a gasoline tax increase will occur. The 4¢ tax, in effect since 1959, has been woefully inadequate to provide for the current and future needs of American's deteriorating highways, roads, and bridges. Now, the Congress—both Senate Majority Leader Howard Baker and Speaker of the House Tip O'Neill—along with the President, support a rise in that modest tax. That kind of non-partisanship is rare, and it is the best indication that the severity of our highway problem has been recognized and action will be taken.

The Administration and Capitol Hill are acknowledging what we have advocated for so long: more revenue used to rebuild our roads can benefit America in many ways. The sooner we begin to reverse the decay of our roads system, the more money we save by avoiding increased construction costs in the future. Through the highway program, people are put to work from the private sector generating direct construction jobs; indirect service and material jobs also are generated. With a gas tax increase, not only will our highways begin to be revitalized, so, too, will our industry.

As I said earlier, lower interest rates are triggering the long-awaited expansion of the housing market. A lower cost of money is going to buoy virtually all businesses. High rates of interest have created bankruptcies, and those businesses that have "held on" have been operating with no growth. Now, with interest rates declining, recovery can't be far behind. As housing and construction recover, we should see a growth in capital investments which will help complete the recovery cycle.

I like to think that a revitalized highway program, coupled with new and increased construction, can only indicate optimism for our stone needs in 1983. For the past few years, we have seen stone demand decline considerably. Crushed limestone use was down 11% in 1980 over '79; it declined a further 10% in 1981 over 1980. It's estimated that, for 1982, crushed limestone used or sold will be down about 9% over 1981. Hopefully, that continued downward trend will have ended by 1983, and we will witness an upturn in 1983 over '82.

With a new Congress coming to Washington in January, we're going to see renewed hope on many fronts. The 97th Congress bogged down on two mammoth issues—taxes and budgets—and so many other pressing concerns were left behind. This Congress is likely to act on a much broader agenda, and, while economic concerns will continue, the 98th Congress will likely demand a greater voice in our economic policy than did the 97th.

Our industry, after weathering some very painful years, appears to be on the eve of a recovery. Along with the nation, we're going to pull ourselves out of the recession. I never assumed that recovery would come quickly, easily, or automatically. Make no mistake about it; it's not here yet, but I have much more reason for optimism today than I did a year ago. I honestly believe 1983 will be a much better year for us all—and we're ready for it!

LIME: plummets in '82

Ken Gutschick
Vice President
& Technical Director
National Lime Association

Starting with the fourth quarter in 1981, lime output has declined rather steadily, and it appears that shipments in 1982 will plummet to 10.8 million tons, down 18% from 1981; this will be the lowest level in 14 years. Refractory dolomite and captive lime will decline even more drastically, so that total lime is expected to approximate 14.5 million tons, down 23% from 1981—making 1982 the worst year since 1965.

Nearly all segments of the diversified lime industry have suffered from the current recession, except for stabilization lime which is holding its own. The biggest loss, by far, is represented by fluxing lime, which in most years accounts for 40-45% of total lime. With the steel industry operating rate falling to 40% of capacity in October and with raw steel production off 39% through October, it is no wonder that fluxing lime has dropped an estimated 36% from the previous year. The next biggest loss in 1982 (percentagewise) has been building lime (for mortar, plaster, and stucco), which has declined 23% in the first 9 months. This decline is, of course, related to the severe recession experience by the construction industry. Chemical and industrial uses for lime (other than steel) have dropped off only 5% in

1982, thanks to environmental uses (water and wastewater treatment, scrubbing SO_2 from stack gases) holding their own. The bright future for lime rests in the environmental uses, particularly scrubbing, which accounted for 900,000 tons in 1981 and should top 1 million tons in 1982.

The steady stabilization market can be explained by the growing off-highway uses compensating for declines in state and local highway construction due to restrictive budgets. Two large stabilization projects of note in 1982 involved new runway construction at the Dallas/Ft. Worth Airport and cooling water reservoir construction at a large power plant in north Texas. In addition, there has been growing use in lime as an anti-stripping agent for asphalt hot mixes, particularly in Georgia and Texas.

Because of the severe recession in the lime industry, numerous kilns have been idled in 1982 and several plants have been shut down or are up for sale. On the other hand, plant expansions have occurred at two plants in Texas (Chemical Lime and U.S. Gypsum) and one in Oklahoma (St. Clair Lime); a new plant (Chemical Lime in Texas) is under construction and another new plant (Continental Lime in Montana) recently has started up. One of the production highlights of the year was the startup of the nation's first coal-fired double shaft (Maerz kiln) at Chemical Lime's Clifton plant.

Prospects for lime in 1983 are up in the air, although there should be a definite improvement, especially during the second half. I am bullish in predicting a 5% increase in lime sales in 1983. Certainly the declining interest rates, coupled with President Reagan's economic program, and the 5¢ gasoline tax (assuming it will pass) should stimulate our economy.

SAND AND GRAVEL: outlook for 1983

Jon I. Mullarky
Vice President
National Sand
and Gravel Association

Estimates of sand and gravel construction aggregate production for 1982 show sales dipping below 700 million tons for the first time since 1958. A reduced level of construction activity diminished sales to all industry markets. Ready mixed concrete producers, major users of sand and gravel aggregates, saw production drop by 8% last year. Highway related markets were off even more as all levels of government struggled to maintain fiscal equilibrium. Survival became the objective for many companies in the industry.

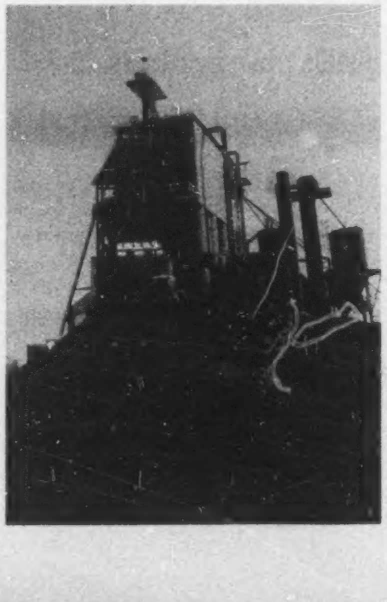
At this time, it is difficult to predict what will happen to construction in 1983, but most economists see some improvement over 1982's bleak activity. At the time this prediction is being written, the housing industry shows signs of a revival, thanks to the reduction of mortgage rates. Repair of the country's infrastructure, especially highways, has become a politically acceptable jobs program to the Administration and many members of the lame duck Congress. It remains to be seen how much, if any, construction will be stimulated in the coming year, but all signs point to a 5-7% increase in sand and gravel production for 1983.

SLAG: prospects look better

H. K. Eggleston
President
National Slag Association

Prospects for 1983 are better than they were for 1982 as an increase in iron and steel production, the source of blast furnace and steel slags, is predicted; and a significant increase is anticipated in highway and housing construction. Highway resurfacing is a major use of slag because of the material's high friction numbers.

Another recent favorable development is the approval of a new ASTM specification—C989-82, Standard Specification for Ground Iron Blast Furnace Slag for Use in Mortars and Concrete. The approval follows slag's use in mortars and concrete in several other countries and extensive testing in the United States to confirm its cementitious value. This will result in considerable blast furnace slag being ground to cement fineness and used either as a blend with portland cement or as one of the cementitious materials added directly at the mixer.



P&Q's annual aggregates survey

Optimism for 1983 tempered by continued decline of 1982

BY SANDY HEROD

In this section of our annual review of the Pit and Quarry industries, the discussion of various factors in sand and gravel, crushed stone, and lightweight aggregate sectors is based entirely on information and data furnished by respondents to our latest year-end survey of Pit & Quarry readers. This one was the 27th annual canvass of the aggregate fields.

The production figures presented by national aggregate association officials in preceding pages of this review usually will be higher than those found in this section. Since our annual survey for this section is directed solely to *aggregate* producers, the data to be presented in the following discussion do not include tonnages of sand and gravel, crushed stone, or other nonmetals used in the manufacture of cement, lime, and glass, in agricultural applications, and in foundries or other industrial applications. Cement, lime, and agstone/aglime are covered elsewhere in this review.

Summary of Pit & Quarry's 1982 Aggregate Industry Survey*

	Sand & Gravel	Crushed Stone	Lightweight Aggregate
Review of 1982			
Production (+ or − vs. 1981)	−16%	−7%	−2%
Prices			
raised (% of replies)	50%	58%	46%
avg. % raised (weighted)	8%	6%	8%
Wages			
raised (% of replies)	96%	97%	69%
avg. % raised (weighted)	7%	6%	8%
Maintenance costs			
up (% of replies)	76%	78%	85%
avg. % of increase (weighted)	10%	11%	22%
Fuel/energy costs			
up (% of replies)	76%	73%	92%
avg. % increase (weighted)	12%	11%	15%
Productivity (T/Mnhr)	+8%	−1%	−19%
Outlook for 1983			
Expect gain (% of replies)	30%	40%	54%
avg. gain expected (weighted)	12%	11%	20%
Expect decrease (% of replies)	15%	20%	31%
avg. drop expected (weighted)	12%	21%	14%
No change (% or replies)	38%	28%	8%
Unsure (% of replies)	15%	12%	7%
Plans reported (% of replies)			
New plants	8%	10%	8%
Expansions	20%	18%	8%
New equipment only	34%	27%	8%

**Does not include processed slags.*

While production experience is the most obvious indicator of trends within an industry, our survey questionnaires have been revised and updated through the years in recognition of newly emergent factors and their impact on industry progress. Information requested and furnished relative to major cost centers, productivity, and pricing furnish significant indicators of the health of the industries; they are particularly pertinent when considered against the background of the economic problems of the past few years.

Our surveys also ask for producer comment on business prospects, plus indication of plans for new plants, expansions, or equipment replacement.

The accompanying table summarizes, by industry, the tabulation and recapping of data submitted. On some factors; i.e., production volume, full year estimates were necessary since the respondents received their questionnaires early in the final quarter of 1982.

A respondent's return is never distinguishable of itself; all data received are combined in the tabulation of the total of responses from each geographical region. On some factors, weighted national averages are presented.

Last year's survey of the industries' performance in 1981 indicated a severe drop in production. In comparing that data with final Bureau of Mines statistics recently reported for 1981, we find that the decrease was on the order of 6% for the combined output of all types of aggregate materials.* This was about half of what had been estimated a year ago.

The combined tonnage of sand and gravel, crushed stone, and slag aggregates totaled some 1.47 billion in 1981 as compared to 1.56 billion the previous year: lightweight aggregate production amounted to approximately 10.1 million tons, also a drop of 6% from 1980.

The respondents to our survey of 1982 have furnished data pointing to a sharper rate of production decline last year with respect to sand and gravel, a drop comparable to that of 1981 for crushed stone, and an appreciable brake on the earlier rate of decline for lightweight materials.

In projecting our respondents' data from the base of final 1981 figures published by the Bureau of Mines, it appears that 1982 output of sand and gravel aggregates dropped about 16% to about 610 million tons, crushed stone aggregate production declined about 7% to 675 million tons, and lightweight aggregate production of about 9 million tons was just 2% off the 1981 pace.

Despite the impact of the weakening economy over the past 3 years, the number of respondents who are optimistic concerning an upward change in 1983 is impressive. As shown in the summary table, they outnumber their less sanguine colleagues within each industry by two to one in two types of aggregates, and nearly so in the third.

Following the discussion of our aggregates survey data are short reviews of each of a number of other major nonmetals industries. The latest government figures available (1981 and partial 1982) are given for lime, agstone, gypsum, phosphate rock potash, barite, feldspar, talc, and fluorspar.

Sand and gravel

In our survey of 1981, our respondents from this industry furnished figures indicating an industry-wide 15% drop in production to some 650 million tons. It now appears the drop was not that severe, although output did decline to the level of 725 million tons.

According to our latest survey, involving estimates for fourth quarter output, production of aggregates in 1982 did take a sharp drop to about 610 million tons. However, optimism still is evident in the replies of one third of our respondents with respect to the coming year, although the weighted average of anticipated gains shown in the table seems overly optimistic.

The table also shows the bind producers are in between declining sales and cost center increases. Although the average increases in costs are slightly lower than reported a year ago for 1981, they continued to be higher, in most instances, than upward adjustments to sales prices.

Of the three major cost elements, maintenance and fuel/energy expense continue to predominate; in 1982, they climbed by 10% and 12%, respectively. Mobile equipment, primarily loaders; parts; and inefficiency of personnel ranked 1-2-3 as the leading problem areas in maintenance. They were closely followed by metal wear problems, trucks, and crusher upkeep.

Wage rates rose at a lower rate than in the prior year, but so did pricing which was adjusted upward by an average of 8%.

Outlook: While 30% of our sand and gravel industry respondents expressed optimism for 1983 (as compared with 38% holding that view of 1982 a year ago), only those in the Southeast and North Central sections of the country outnumbered their more pessimistic colleagues. Nationally, 15% anticipate a further drop; 38% feel the situation will remain static; and 15% express uncertainty.

With some relief from high interest rates and inflation being experienced, there appears to be a modest improvement in the physical volume of construction in the offing. Estimates for that gain range from 3% to 5%; should such gains be realized, the demand for sand and gravel aggregates could result in a 1983 output of perhaps 625 million tons.

Crushed stone

In reporting the results of our 1981 survey last January, it was estimated that about 670 million tons of crushed stone aggregates were produced. That was about 7% below the final 1981 figure of 725 million later published in government reports which, in turn, represented a drop of 7% from the final 1980 figure of 778 million tons.

Our latest canvass of crushed stone producers points to another 7% drop in 1982; projection of full-year estimates from the Bureau of Mines' 1981 base figure show production of some 675 million tons.

The uninterrupted slides of the past 3 years apparently have not dimmed expectations of a substantial number of our respondents for improvement during 1983. They were greater in number than a year ago, and somewhat fewer expressed expectations of further decline.

There were some slight decreases in the rates of climb of the major cost centers; as seen in the table, they were, in each factor, within a percentage point of those shown for sand and gravel. Maintenance and fuel/energy expense rose by 11%, and wages by an average of 6%. However, productivity was down slightly, and prices

**Includes iron and steel slag per reports by the Bureau of Mines.*

were raised only 6% as compared with higher increases in the cost centers.

Mobile equipment—trucks, loaders, and dozers—ranked at the top of the list of the most troublesome maintenance areas, but were followed closely by parts availability and wear and tear on crushers.

Outlook: As seen in the summary table, 40% of our quarrymen respondents reported optimism for the coming year; the weighted national average of expected improvement is on the order of 11%. That outlook is tempered by the pessimists, only half that number, who project a further decline of about 21%. Uncertainty was indicated by 12% of the total responding, and 28% expect 1983 to remain at the same level as last year.

As confusing as the economic forecasts have been for the past 3 years, there have been decreases in inflation and interest rates. This has led many construction and money experts to the opinion that construction should begin to register a small gain (physical volume) during the coming year; at an estimated increase of about 4%, there could be an increase in crushed stone production to the level of 700 million tons.

Lightweight aggregates

In reporting a year ago on our 1981 survey returns, complemented by the latest government data then available on certain types of lightweight materials, we estimated that a drop of 6% was experienced from the 1980 level. Revised, final data now published indicate that the decline was 6% and that total production of all lightweight materials was just over 9.3 million tons. This includes the output of expanded clay, shale, and slate, and of pumice, expanded perlite, and exfoliated vermiculite. All are used as construction aggregates or in related applications.

Our 1982 survey returns, along with preliminary government data, point to a drop of just 2% last year in combined tonnage, or a total of 9.1 million tons.

Owing to the nature of processing methods for the majority of lightweight aggregate producers, fuel and energy costs understandably are the major production expense; more than 90% have reported increases that average out at 16%. Maintenance cost increases also are higher than in the other aggregate categories, averaging 22%; and tons/manhour productivity showed a drop of 19%. At the same time, lightweight prices across the board were raised at about the same degree as other types of aggregates.

Outlook: Within their own group, respondents to the lightweight aggregate industry survey show a higher number of optimists (54% of replies) and pessimists (31% of the returns) than is the case in either of the other two aggregate groups.

Considering the fact that the lightweights experienced a relatively modest 2% decline last year, and that an increase, however small, has been projected for the coming year, it appears reasonable to anticipate that production of lightweights during the coming year will reach the level of about 9.5 million tons.

Slags

Since these materials are a byproduct of iron and steel production, the output of the latter controls the amount of slag available to processors. Most workable iron (blast furnace) slag banks accumulated in years past have been processed, and the availability of iron slag now is dependent largely on newly produced blast furnace iron.

Steel slags, of which there remain substantial banks, have a narrower market range, and the current economy has had the same effect on production and sales as it has had on other construction-oriented materials.

According to the latest government report on the slag industry, iron and steel slag processed tonnage dropped 15% in 1981 to the level of 21.5 million. Of that volume, 800 thousand tons was expanded iron slag, a drop of 30%.

The final data for 1982 are not yet available, but the reduced pace of the iron and steel industry and the lack of evidence pointing to a significant change suggest a further reduction in slag processing during the past year and a relatively modest increase in demand during 1983.

Other major nonmetals

BY SID LEVINE

Agstone

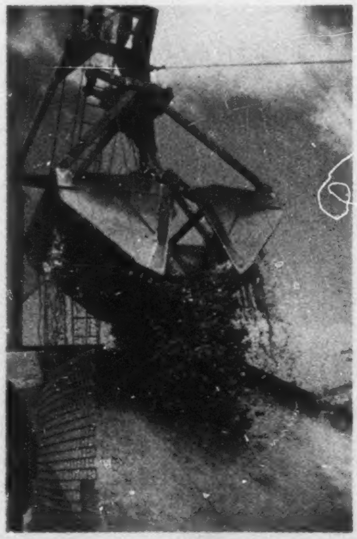
Agricultural limestone sold or used by producers in the United States amounted to 29.65 million short tons in 1981 compared to 34.40 million tons in 1980 and 32.88 million tons in 1979. Agstone constituted about 4% of 1981 crushed limestone production, 4.6% of 1980 output, and 4% of 1979 production. Agstone value totaled $130.3 million in 1980 and $116.3 million in 1979.

Barite

Estimated U.S. mine production of barite (primary barite sold or used by producers) in 1981 rose to a record high level of 2.4 million short tons valued at $85 million. About 4.1 million tons of ground barite from domestic production and imports was sold in 1981. More than 95% of the barite produced was used as a weighting agent in oil well and gas well drilling muds. Other uses for barite included applications in paints, glass, rubber, and in the production of barium chemicals.

Feldspar

Total U.S. feldspar output in 1981 (including soda, potash, and mixed varieties) amounted to



665,000 tons (valued at $21 million) compared with 710,000 tons (valued at $23.2 million) in 1980. The 1981 end use distribution of feldspar in the United States indicated that 57% went into glassmaking and 40% into pottery. The remaining 3% was used in other applications such as enamels, sanitary ware, and fillers.

Fluorspar

U.S. fluorspar production segments in 1981 (in short tons) were: mine production, 415,862; material beneficiated, 419,058; material recovered, 111,281; finished (shipments), 115,404 (value f.o.b. mine, $18.412 million). Finished shipments in 1980 totaled 92,635 short tons (valued at $12.611 million).

The United States continues to depend on foreign sources to supply more than 85% of its fluorspar requirements. Imports for consumption amounted to 826,783 tons in 1981 (valued at $104.9 million, c.i.f. U.S. port) and 899,219 tons (valued at $94.1 million) in 1980.

Reported consumption in 1981 amounted to 932,855 tons with the following percentage end use of product: hydrofluoric acid, 56.36%; glass and fiberglass, 1.10%; enamel and pottery, .13%; welding rod coatings .20%; primary aluminum and magnesium, .06%; iron and steel castings, 1.32%; open-hearth furnaces, 7.14%; basic oxygen furnaces, 25.85%; electric furnaces, 7.63%; other, .21%.

Gypsum

In 1981, U.S. producers mined 12 million tons of crude gypsum, valued at $104 million, compared to 12.4 million tons valued at $103 million in 1980. Crude gypsum imports amounted to 7.6 million tons in 1981 and 7.4 million tons in 1980. By-product gypsum quantities were 610,000 tons in 1981 and 663,000 in 1980.

Of the total supply of crude gypsum, 15.6 million tons were calcined for gypsum products, and 4.6 million tons were used mainly as a cement retarder or as agricultural land plaster. The calcined gypsum was sold as prefabricated products or as industrial or building plaster. Sales of gypsum in 1981 for use in cement were 3.1 million tons; for agriculture, 1.3 million tons; and for industrial and building plaster, 758,000 tons.

Lime

Lime producers in the United States sold or used 18.9 million short tons of lime, valued at $884 million, and in 1980, 19 million tons valued at $843 million. In 1981, quicklime accounted for 86% of the total production, hydrated lime for 12%, and dead-burned dolomite for 2%. Open market sales used about 75% of the 1981 production. End use sales groups were: chemical and industrial uses, 87%; construction, 7%; refractories, 5%; agriculture, 1%. The leading individual uses for lime were steel furnaces, water treatment, alkalies, and paper and pulp. Dead-burned dolomite is used for refractories.

Phosphate rock

Mine production of phosphate rock in the United States amounted to 183.7 million metric tons in 1981 and 209.9 million metric tons in 1980. Marketable production totaled 53.62 million metric tons (valued at $1.44 billion) in 1981 and 54.42 million tons (valued at $1.26 billion) in 1980.

Phosphate rock sold or used by U.S. producers amounted to 45.526 million metric tons (valued at $1.21 billion) in 1981 and 54.581 million tons (valued at $1.24 billion) in 1980. Domestic uses of phosphate rock sold or used by U.S. producers in 1981 amounted to 35.13 million metric tons for the following uses: wet-process phosphoric acid, 82.8%; normal superphosphate, .5%; triple superphosphate, 3.4%; defluorinated rock, 1.4%; direct applications, .1%; elemental phosphorus, 11.5%; ferrophosphorus, .3%.

Potash

U.S. production of potash totaled 4.153 million metric tons (2.156 million metric tons K_2O equivalent) in 1981 and 4.315 million tons (2.239 million tons K_2O equiv.) in 1980. Sales by producers were 3.670 million tons (1.908 million tons K_2O equiv.) in 1981, valued at $329 million, and 4.265 million tons (2.217 million tons K_2O equiv.), valued at $354 million, in 1980. Potash sold or used in the United States in 1981 amounted to 3.670 million metric tons (1.908 million tons K_2O equiv.) for the following uses: muriate of potash (60% K_2O minimum) for standard, coarse, granular, and chemical grades, 68.8%; potassium sulfate, 9.4%; other uses including soluble muriate, manure sales, and potassium magnesium sulfate, 21.8%.

Talc

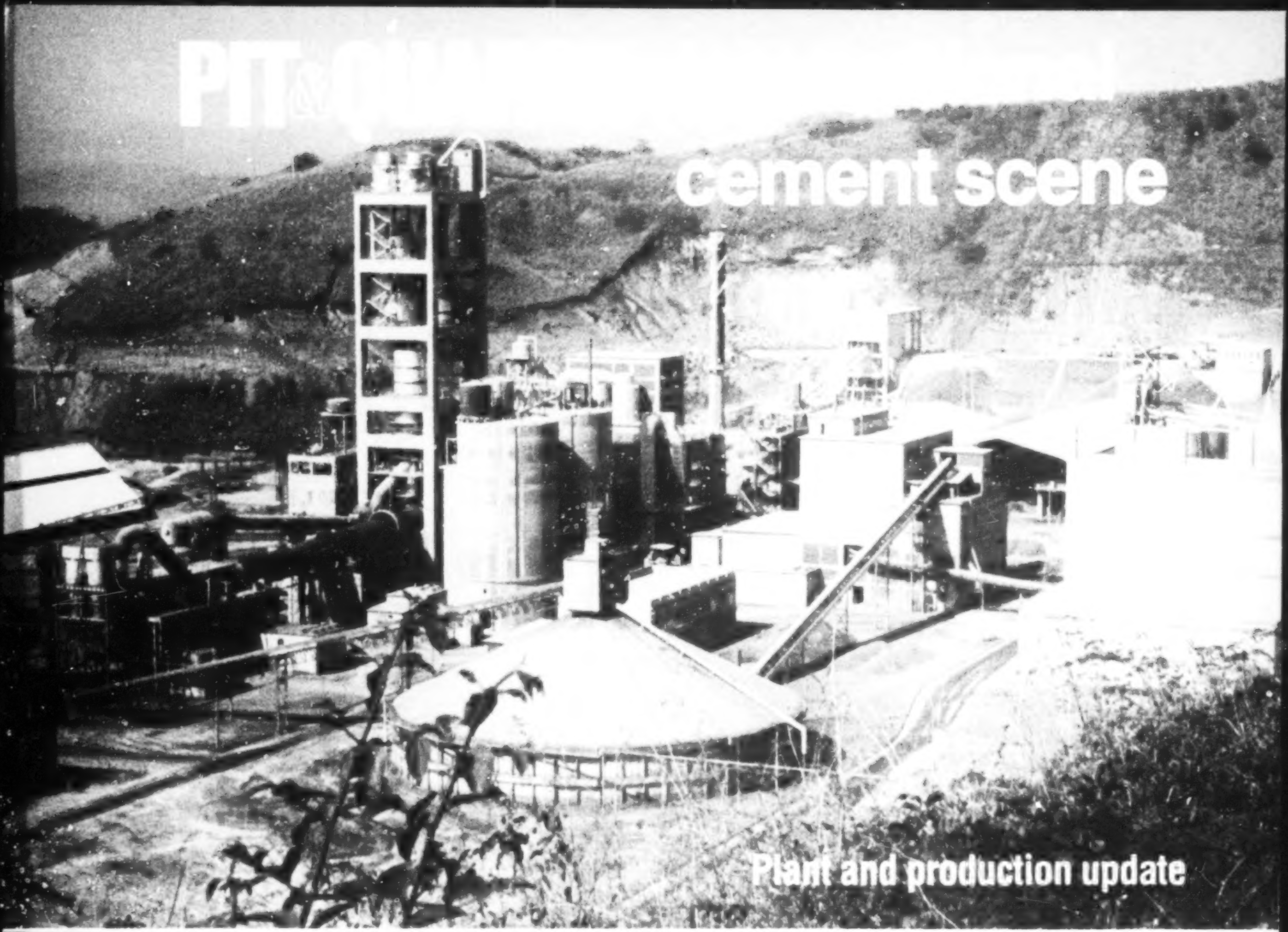
Mine production of crude talc amounted to 1.24 million short tons valued at $30.66 million in 1981 and 1.13 million tons, valued at $25.25 million, in 1980. Crude and processed talc sold by producers totaled 1.12 million tons ($95.35 million value) in 1981 and 1.17 million tons ($84.52 million value) in 1980.

End uses for the .982 million tons of ground talc utilized in 1981 were: ceramics, 38.2%; cosmetics, 7.6%; insecticides, 1.3%; paint, 21%; paper, 9%; plastics, 11.3%; refractories, .2%; roofing, 2.6%; rubber, 3.7%; other, 5.1%. ●

PIT&QUARRY

PIT&Q [illegible] cement scene

Plant and production update



Brazil: Cimento Mauna S.A. (Cantagalo). Rated at 700,000 mtpy; new plant onstream in 1982 incorporates an F.L. Smidth precalciner kiln. *(Courtesy F.L. Smidth & Co., Inc.)*

BY SID LEVINE

World cement production reached a record level of an estimated 888.1 million metric tons in 1981 the latest year for which data are available; the total, however, was only about 1% over 1980. Total output of the 19-member countries of the European Cement Association (CEMBUREAU) dropped from 212 to 211 million metric tons (.5%). Cement production in the United States decreased about 5% in 1981 compared to 1980.

World cement market conditions were not expected to show an improvement in 1982, according to the 1981 annual report of Heracles General Cement Co. (Greece). The company attributes the situation to the opening of new cement works in developing countries, the depressed international economic situation, and the erosion of the currency reserves of most oil-producing countries.

Domestic sales within the CEMBUREAU producer companies fell from 187 to 179 million metric tons in 1981 (−4.4%) as a result of the decline of economic activity and building construction. Italy was the only CEMBUREAU country in which cement consumption increased in 1981. On the other hand, the Heracles report notes, there was a considerable increase in CEMBUREAU exports to countries outside Western Europe; exports rose from 26.7 to 32.3 million metric tons. These improved export figures were made possible by the large demand increase in such countries as Egypt, Nigeria, Saudi Arabia, and Iraq.

1981 construction activity was characterized, in large measure, by the unsatisfactory performance of the national economies as Holderbank Management and Consulting Ltd. (Switzerland) pointed out in its 1981 annual report. In Europe and North America, the construction industries suffered from worsening business conditions. In contrast, demographic growth and the realization of major projects helped the demand for construction work to remain at a satisfactory level in most countries of the Third World.

Projected onstream dates for new cement plants and plant extensions, and a listing of projects placed in operation in 1981 and 1982, are given in this annual Pit & Quarry report. Where data were available, cement production figures are provided for 1979-1981 for the several countries.

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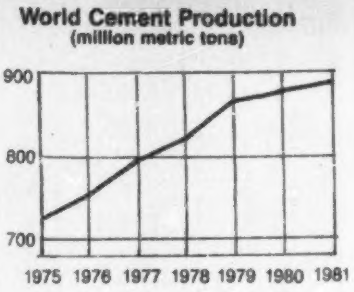

Leading Cement Producing Countries
(production 10 or more million metric tons per year)

	1979	1980	1981
U.S.S.R.	123.0	124.8	127.0
Japan	87.1	87.4	84.8
China	73.9	79.9	84.0
United States	74.5	66.8	63.6
Italy	39.5	41.9	42.0
West Germany	34.7	33.1	33.0
France	31.2	30.6	28.2
Spain	29.3	29.6	28.6
Brazil	24.9	27.2	28.5
Poland	19.2	18.4	14.2
India	18.3	17.8	20.8
Mexico	15.2	16.3	17.0
Romania	14.7	16.0	14.8
South Korea	16.6	15.6	15.6
United Kingdom	16.2	14.9	13.3
Taiwan	11.9	14.1	14.3
Turkey	13.9	12.9	14.0
East Germany	12.3	12.4	12.5
Greece	12.1	12.6	13.5
Czechoslovakia	10.3	10.6	10.7
Canada	11.1	10.0	10.4

World Cement Production
(million metric tons)

	Million metric tons	% annual change
1981	888.1	1.0%
1980	879.4	1.3
1979	868.1	5.8
1978	820.4	3.3
1977	794.0	5.6
1976	752.0	4.6
1975	719.0	—

AFRICA: Cement Production—1978-81

	1978	1979	1980	1981*
Algeria	2.699	3.774	4.156	4.20
Angola	.170	.200	.230	.25
Benin	.230	.250	.280	n.a.
Cameroun	.417	.487	.480	.27
Central African Republic	—	—	—	n.a.
Congo Republic	.065	.055	.060	n.a.
Egypt, Arab Republic of	3.028	2.987	3.105	3.55
Ethiopia	.099	.103	.110	.20
Gabon	.140	.140	.110	.11
Ghana	.489	.270	.281	.24
Guinea, Republic of	—	—	—	n.a.
Ivory Coast	.962	.950	.900	n.a.
Kenya	1.140	1.136	1.271	1.30
Liberia	.133	.136	.106	.10
Libya (Libyan Arab Republic)	1.232	1.800	2.300	3.20
Madagascar, Democratic Republic of (Malagasy Republic)	.066	.065	.020	.06
Malawi	.103	.113	.092	.10
Mali	.034	.020	.020	.02
Morocco	2.819	3.317	3.561	3.60
Mozambique	.371	.300	.236	.50
Niger	.043	.045	.045	.04
Nigeria	1.500	2.000	2.400	2.00
Reunion	.132	.160	.145	n.a.
Senegal	.357	.380	.371	.39
Somalia	—	—	—	n.a.
South Africa, Republic of	6.824	6.190	7.421	7.98
Sudan	.142	.150	.160	.18
Tanzania	.253	.298	1.100	1.20
Togo (see also West Africa)	.328	.299	.655	n.a.
Tunisia	.882	1.439	1.776	2.01
Uganda	.090	.070	.01	.01
West Africa (Togo, Ghana, & Ivory Coast)	—	—	—	n.a.
Zaire	.474	.413	.443	.40
Zambia	.123	.20	.16	.16
Zimbabwe	.404	.396	.469	.40

**Preliminary*
n.a. . . . not available at time of writing
Quantities in million metric tons (tonnes)
1 tonne = 1.10231 short tons

AFRICA

Algeria

Cement plants are state-owned under departmental jurisdiction of Societe Nationale des Materiaux de Construction.

- Bouira: F.L. Smidth & Co., Denmark, and F.L. Smidth & Cie., France, will supply a turnkey cement plant with a 1 million tpy capacity. The plant will be located near Sour-El-Grhozlane in the Bouira district, about 140 km southeast of Algiers. Scheduled operation: 1983. Consulting engineers: Cimenteries CBR (Belgium)
- Hamma-Bouziane (Constantine): New 1 million mtpy scheduled onstream in 1981. Major equipment supplier: Creusot-Loire Enterprises. Consulting engineers: Cimenteries CBR (Belgium)

Benin

- Societe des Ciments d'Onigbolo, Onigbolo: Two neighboring West African states, the People's Republic of Benin and the Federal Republic of Nigeria, have jointly awarded F.L. Smidth & Co. A/S a contract for the construction of a cement plant with a capacity of 500,000 tpy. The dry process plant will include a Tirax raw mill, 4.6mm × 8.25m, with a 4.4m drying chamber, a 1,600 tpd oil-fired four-stage preheater Unax kiln, 4.55 × 68m, and a Unidam cement mill, 3.8m × 12m. Onstream: 1982.

Cameroun

- Cimenteries du Cameroun, Figuil: Expanding from 70,000 tpy to 100,000 tpy. Scheduled onstream: 1982.
- Cimenteries du Cameroun, Douala: Raising production capacity at the Bonaberi clinker crushing works from 480,000 to 870,000 tpy. Scheduled onstream: 1983.

Congo Republic

The Congolese government is modernizing and expanding its existing Cidolou operations from 80,000 to 120,000 tpy. Project due for completion in 1983. Prospective Engineering Gestion (Switzerland) is acting as consultant and project manager.

Egypt, Arab Republic of

- Tourah Portland Cement Co., Lecaire (Tourah): Adding 2,000 mtpd F.L. Smidth dry process kiln equipped with cyclone preheater and a precalciner. Onstream: 1982.
- National Company for the Production of Cement, El-Tabbin (30 km south of Cairo): Adding 4,500 tpd production line. Major equipment suppliers are KHD Humboldt Wedag and CGEE Alsthon S.A. Clinker will be produced in a 76m long × 5m diameter rotary kiln with a twin-type preheater and an additional in-line firing arrangement. Scheduled onstream: 1983. Dyckerhoff

Zementwerke supplying consulting services.

- Suez Cement Co., Eastern plant, south of Suez City at Beer Odeib: Building new 1 million mtpy plant. Fuller Co. supplying equipment, including 15 ft. × 42 ft. raw mill; SF-141 preheater with flash calciner; 15 ft. × 16 ft. × 240 ft. rotary kiln; two 15 ft. × 46 ft. finish mills; grate clinker cooler; blending and raw storage silos; Fuller-Kinyon systems; dust collectors; fluidizing gravity conveying systems. Ferguson International Co. is project manager and consultant. Participating are: Arab Consulting Engineers; Arab Swiss Engineering Co.; Bendy Engineering Co. (process review); Morrison-Knudsen (quarry, plant, and development) H.K. Ferguson, San Francisco Division (coordination of U.S. subcontractors, purchasing, expediting, construction estimate, and portion of engineering). Scheduled onstream: 1983.
- Suez Cement Co. Quattamia cement plant: New 1.4 million mtpy plant is scheduled to be commissioned in 1984. Polysius is supplying major equipment, including: two 13.8 ft. × 42.7 ft. double rotator raw mills; one Prepol precalciner kiln rated at 4,950 mtpd; two two-compartment 15.1 ft. × 50.9 ft. cement mills; two homogenizing silos.
- Helwan Portland Cement Co. (Helwan): Consortium, formed by F.L. Smidth & Co. (Denmark) and Brown, Boveri & Co. (Switzerland), awarded contract by company to convert two existing wet process production lines to dry process. Both lines will incorporate F.L. Smidth precalcining systems with 4,500 mtpd four-stage preheater kilns. Capacity: 3 million mtpy. Scheduled onstream: 1982.
- Helwan Portland Cement Corp. (Assiut): A 1.5 million mtpy plant is being built by a European consortium headed by Polysius. Equipment will include: four-stage Dopol heat exchanger; Prepol AS precalciner; rotary kiln; two raw-mix grinding mills with a capacity of 210 mtph each; two cement-grinding mills, each rated at 83 mtph; raw materials handling and dressing plant; mixing beds for limestone and clay; raw mix homogenizing plant; clinker handling system; Polab II laboratory automation. Electrical equipment supplier: Brown Boveri. Bulk loading and bagging plant: Haver & Boecker. Consultants: Arab Swiss Engineering Co. Scheduled onstream: 1982.

Egypt: Tourah Portland Cement Co. (Lecaire). Added F.L. Smidth cyclone preheater/precalciner kiln unit rated at 2,000 mtpd; onstream in 1982. *(Courtesy F.L. Smidth & Co. Inc.)*

- Helwan Portland Cement Co., Naga Hammadi (100 km. northwest of Luxor): New plant consisting of two 3,700 tpd each KHD Humboldt-Wedag Pyroclon system pyroprocessing lines. Units will include 67 × 4.8m rotary kilns equipped with preheater units and 52 × 6m tubular coolers.

Ethiopia

Ethiopian Building Materials Corp., Mugher: New 300,000 mtpy under construction. Scheduled onstream in 1983. Consulting engineers: Cimenteries CBR (Belgium).

Ghana

(see West Africa)

Guinea, Republic of

- Conakry: Contract awarded to Lafarge Conseils et Etudes for supervision of construction of clinker grinding plant in Conakry. Capacity: 250,000 mtpy. Startup scheduled for 1981. The project is sponsored by the government of the Republic of Guinea, represented by the Estate Committee for Cooperation with the countries of the Arab League (Ministry of Planning and Cooperation). Prospective Engineering Gestion was consulting engineer.
- Cement plant construction scheduled to start in 1982 at Sougueta (about 200 km north of Conakry). Prospective Engineering Gestion is consultant.

Ivory Coast

(see West Africa)

Lebanon

Societe des Ciments Libanais, Chekka, intends converting production lines 5 and 6 of the Chekka plant from wet to dry process. The actual kiln capacity is to be increased from 1,500 to 3,000 tpd each; for raw meal grinding two roller mills of 140 tph shall be installed. The main machinery to be ordered by the end of 1982. Holderbank Management and Consulting Ltd. is acting as consulting engineer.

Libya (Libyan Arab Republic)

- Secretariat of Heavy Industries planning 1 million mtpy plant at Juffrah or Wadi-Shati. Consulting engineers: The Kuljian Corp. (U.S.A.) and Development Consultants International Ltd. (Hong Kong).
- El Fataiah Cement plant, being built at Derna by the Heavy Industries Secretariate, Tripoli, should start production in early 1983. The 1 million tpy plant consists of two identical production lines with kilns of 1,600 tpd capacity each. Mitsubishi Heavy Industries, Japan, has been engaged as general contractor. Brown Boveri Co. supplied the electrical equipment and Polimex-Cekop Ltd. Poland will provide the civil works and the erection of the plant. Holderbank Management and Consulting Ltd. is supervising engineering and construction.

Madagascar, Democratic Republic of (Malagasy Republic)

E.S. Cement d'Antsirabe (Ibity, Province of Antsirabe): Contract awarded to Loesche GmbH for construction of new vertical kiln cement plant rated at 115,000 mtpy. Scheduled onstream: 1981.

Mali

The government of the Republic of Mali is building a second cement plant with a capacity of 260,000 tpy at Diamou (400 km west of the capital, Bamako). Clinker grinding station will be built at Bamako. Clinker will be transported by rail from Diamou to Bamako. Plant is scheduled to go onstream in mid-1984. Prospective Engineering Gestion (Switzerland) is handling engineering and project management.

Morocco

Cimenterie Nouvelle de Casablanca: Lafarge Conseils et Etudes are consulting engineers for 1.2 million mtpy, dry process plant scheduled for 1983 operation near Bouskoura. Fives-Cail Babcock is the turnkey contractor.

Niger

Malbaza-Societe Nigerienne de Cement: Lafarge Conseils et Etudes is consultant for 300,000 mtpy plant expansion incorporating a dry process preheater system. Startup is scheduled for 1983.

Nigeria

- Cement company of Northern Nigeria, Kalambaina, Sokoto: A German-Swedish consortium consisting of O&K Orenstein & Koppel AG, Michael Thomas & Partner KG, and Cementa AB, Malmoe, has received an order for the refurbishment and extension of the Sokoto cement works. The expanded plant will be rated at 600,000 mtpy.
- Benue Cement Co. Ltd.—Yandev plant: New plant, incorporating two production lines rated at 1,450 mtpd clinker each, was scheduled for startup 1979. Major equipment, supplied by Humboldt Wedag, includes two 4.4×64m rotary kilns equipped with four-stage Humboldt preheaters; two 4.4×8m tube mills for raw meal grinding. Consulting engineers: Cementia Engineering & Consulting Ltd., Switzerland.

Somalia

Berbera Cement plant: Lafarge Conseils et Etudes, a division of Lafarge Coppee, recently signed a contract for engineering consultancy work with the Ministry of Industry of the Republic of Somalia for the conversion and completion of the Berbera cement plant. The new dry process works will have an annual capacity of 200,000 tons; equipment for the project is being supplied by Creusot Loire Enterprises. The commissioning of the new unit is scheduled for the end of 1983.

South Africa, Republic of

- Anglo-Alpha Ltd., Sandton, RSA, has entered into a contract with Krupp-Polysius for the supply of all mechanical equipment for a new 4,000 tpd cement production line at their ULCO works. Startup is scheduled for the second half of 1984. Project management and civil engineering will be carried out by AATS in South Africa. Holderbank Management and Consulting Ltd. is responsible for plant design and mechanical and electrical engineering including control and instrumentation engineering.
- A contract for mechanical equipment has been awarded by Anglo-Alpha Ltd. to F.L. Smidth for the raw and coal milling and the kiln for the new 1,450 tpd clinker plant at Natal Simuma. The contract for crushing, stacking/reclaiming of coal, limestone, and additives, as well as the sampling plant, supply, and erection, has been awarded to PWH. ASEA was awarded the contract for electrical equipment. Startup is foreseen for October 1983. Project management is carried out by Anglo-Alpha Technical Services. For plant design, control, and instrumentation engineering, AATS has appointed Holderbank Management and Consulting Ltd. of Switzerland.
- Blue Circle Cement, Lichtenburg: Extension is adding one Polysius Prepol precalciner/Dopol kiln plant. Kiln is a 14 ft. × 207 ft. unit rated at 1,430 mtpd. Scheduled onstream in 1982.
- Natal Portland Cement Ltd.: F.L. Smidth is to provide mechanical equipment, erection supervision, and commissioning of a new 1,450 tpd cement plant. FLS equipment includes raw grinding plant with 4.6×8.25m Tirax-Unidan mill and Symetro gear, 4.35 × 66m four-stage cyclone preheater kiln with Unax cooler and dedusting by electrostatic precipitator, and Tirax coal grinding plant. Main contractor is Sumuma Construction (pty) Ltd.

Sudan

- Maspio Cement Corp.: Expanding Atbara plant. Major equipment, supplied by F.L. Smidth, includes one 750 tpd rotary kiln, 15 ft. × 12½ ft. × 329 ft., with single-stage cyclone preheater and Unax planetary cooler; 10½ ft. × 30 ft. raw mill; 11 ft. × 36 ft. finish mill. Scheduled onstream in 1982.
- Sudan Eagle Cement Co.: Feasibility studies for new 500,000 mtpy cement plant project being prepared by Asland S.A. (Spain).

Tanzania

- Tanzania Saruji Corp.: Building a new plant at Tanga (in northeastern Tanzania). F.L. Smidth supplied major equipment including one 1,600 tpd kiln, 15 ft. × 224 ft., with four-stage cyclone preheater and Unax planetary cooler; 15 ft. × 25 ft. raw mill; 14½ ft. × 43 ft. finish mill. Onstream in 1981. Consultants: The Kuljian Co. (U.S.A.) and Development Consultants Pvt. Ltd. (India).
- Tanzania Saruji Corp.: Awarded contract to F.L. Smidth to supply equipment for new 800 tpd plant at Mbeya in southwestern Tanzania. Major equipment includes 4×6m, 1250 kW raw mill; 3.95×58m, 800 mtpd rotary kiln equipped with a four-stage cyclone preheater and Unax planetary cooler; 3.4×12m, 1820 kW finish mill. Scheduled onstream in 1982. Consultants: The Kuljian Co. (U.S.A.) and Development Consultants Pvt. Ltd.

Togo (see also West Africa)

Ciments du Togo, Lome, Togo: Extending capacity of clinker grinding plant from 250,000 mtpy to 400,000 mtpy. Scheduled for completion in 1982. Consulting engineers: Prospective Engineering Gestion.

Tunisia

- Societe des Ciments de Jebel el Quest: New 3,300 tpd clinker plant to be built in Bir M'Cherga (30 miles south of Tunis). Polysius S.A. (France) has turnkey order which will include a Prepol-AS precalciner, air-swept grinding plant for raw meal, two two-compartment cement grinding mills, and Polab laboratory automation. Commissioning scheduled for 1985.

- Societe des Industries Cimentieres du Centre (SICC) has signed a contract with Holderbank Management and Consulting Ltd. for the engineering and project management of a cement plant to be built near Enfida (100 km east of Tunis). The plant will be rated at 1 million tpy. Production is slated for 1983 startup. Equipment will be supplied by Kawasaki Heavy Industries in cooperation with C. Itoh & Co. and Marubeni Corp. Pyroprocessing unit will include a Kawasaki suspension preheater.
- Societe des Ciments Tunisiens: Planning 1 million mtpy dry process plant in the Tunis area at Djebel Oust. Scheduled for 1983 operation. Consulting engineers: Lafarge Conseils et Etudes.
- Societe Tunisienne de Ciment Blanc: White cement works, rated for 100,000 mtpy. Scheduled for 1984 operation. Consulting engineers: Lafarge Conseils et Etudes.

Uganda

- Uganda Cement Corp., Hima (near Zaire border): Adding 600 tpd production line. Contract awarded to Humboldt Wedag. Dry process, using a preheater, 50 × 3.6m rotary kiln and a grate cooler.
- The Turkish Cement Industry Corp. is preparing a feasibility study for a cement plant in Uganda.

West Africa

Ciment de l'Afrique de l'Quest (CIMAQ), Tabligo, Togo: Company formed by the West African governments of Togo, Ghana, and Ivory Coast to build a 1.2 million mtpy cement plant near Tabligo. Blue Circle Group (Great Britain) has contract for engineering services. Polysius supplied major equipment including two Prepol precalciner kilns, each rated at 2,100 mtpd clinker. Onstream in 1981.

ASIA: Cement Production—1978-81

	1978	1979	1980	1981*
Afghanistan	.160	.14	.50	.60
Bahrain	.210	.200	.200	n.a.
Bangladesh	.312	.323	.336	.35
Burma	.250	.370	.400	.38
China, People's Republic of	65.24	73.90	79.86	84.0
Hong Kong	1.236	1.279	1.489	1.51
India	19.561	18.249	17.756	20.76
Indonesia	3.628	4.627	5.831	6.30
Iran	6.093	8.5	8.0	8.0
Iraq	6.5	5.9	6.1	5.6
Israel	1.996	1.919	1.850	2.31
Japan (includes Ryukyu Islands)	84.353	87.131	87.410	84.83
Jordan	.553	.623	.913	1.00
Korea (North Democratic Peoples Republic)	8.5	8.0	8.5	7.98
Korea (South), Republic of	15.467	16.614	15.573	15.62
Kuwait	1.350	1.500	1.900	n.a.
Lebanon	1.070	1.610	1.484	2.20
Macau	—	—	—	n.a.
Malaysia	2.200	2.304	2.352	2.60
Mongolia	.170	.185	.200	.18
Nepal	.035	.050	.050	.03
Oman, Sultanate of	—	—	—	n.a.
Pakistan	3.228	3.000	3.350	3.50
Philippines	4.147	3.940	4.516	4.60
Qatar	.211	.248	.208	.26
Saudi Arabia	1.510	1.800	3.000	5.00
Singapore	1.575	1.643	1.831	2.00
Sri Lanka	.575	.662	.650	.60
Syria (Syrian Arab Republic)	1.487	1.847	1.995	2.15
Taiwan	11.461	11.891	14.062	14.34
Thailand	5.180	5.243	5.330	6.00
United Arab Emirates (Abu Dhabi, Dabai, Sharja, Ajman, Fujaira, Umm al Quaiwan, Ras al Khaima)	.681	1.300	1.600	n.a.
Vietnam	.800	1.000	1.100	n.a.
Yemen (Yemen Arab Republic)	.062	.062	.065	.08

**Preliminary*

n.a. . . . not available at time of writing

Quantities in million metric tons (tonnes)

1 tonne=1.10231 short tons

ASIA

Afghanistan

In Kandahar region: New 1,600 mtpd plant is scheduled. Contract awarded to consortium consisting of Fuller Co., Fischbach-Moore International, and Oman Construction. Pyroprocessing system includes two preheater-equipped rotary kilns.

Burma

From Ceramic Industries Corp. Fives-Cail Babcock has received a contract for an 840 mtpd dry process (suspension preheater) plant at Pa-An. Scheduled operation: 1983.

China, People's Republic of

- China National Technical Import Corp., Jidong: A 1.2 million tpy plant composed of two 3,850 kW, 4.5 × 13.9m raw mills, a 4,000 mtpd, 4.7 × 74m rotary kiln with IHI-NSF coal-firing precalciner with four-stage preheater and grate cooler; two 4,200 kW, 4.5 × 15.1m cement mills. Scheduled for 1983 operation.
- Guangxi Building Materials Export Supply Corp., Liuzhou: F.L. Smidth & Co., Denmark has received an order for the supply of machinery and equipment for a 3,200 tpd cement plant as an extension of the Liuzhou plant. The main machinery includes Duodan raw grinding plant, 4.55 × 68m precalciner kiln with Folax grate cooler and cement grinding installation with two cement mills. The order includes erection assistance, supervision, and commissioning.
- For 4,000 tpd coal-fired plant in Anhui Province, joint order in 1980 to Mitsubishi Heavy Industries, Ltd., Mitsubishi Mining & Cement Co., Ltd., and Meiwa Trading Co. Ltd. Scheduled for completion in 1984.

Hong Kong

China Cement Co: Building new 1.5 million tpy plant in Castle Peak (New Territories). Scheduled onstream in 1983. Raymond Kaiser Engineers is providing engineering and construction management services. Major equipmen provided by Allis-Chalmers, including 4,600 mtpd reinforced suspension preheater with major process auxiliaries and clinker grinding equipment; preheater tower (about 326 ft. in height); 16 ft. × 250 ft. rotary kiln; three Compeb rotary finish mills, each 5,625 hp, 15 ft. diameter × 45½ ft.

India

- Mysore Cements Ltd: New dry process plant rated at 1,500 tpd in operation in 1982 at Damoh in the state of Madhy Pradesh. Principal equipment supplied by KHD Humboldt-Wedag. The 3.8 × 50m kiln is equipped with a five-stage Pyroclon preheater.
- Indian Rayon Corp. Ltd. will build a plant in Rayon (about 200 km. southeast of Hyderabad.) The plant will be rated at 1,500 tpd and will include a 3.8m × 50m rotary kiln equipped with a KHD Humboldt-Wedag Pyroclon preheater.
- Coromandel Fertilizers Ltd. of Secunderabad in India has awarded Krupp Polysius A.G., Beckum, West Germany, a contract to supply a cement plant with a capacity of 3,300 tpd. The plant will be situated between Hyderabad and Madras. Commissioning is scheduled for mid-1983. A Dopol preheater kiln with Prepol-AS precalciner, two roller mills for the raw material, one roller mill for coal, two cement mills, one blending bed, and automation equipment are to be supplied.
- Texmaco Ltd. Yerranguntla, Andhra Pradesh: Holtec Engineers has been retained for a 1,500 mtpd plant scheduled onstream in 1984.
- Modi Rubber Ltd.: Holtec Engineers has prepared a report for a new 1 million mtpy cement plant to be located in the Raipur district of Madhya Pradesh in central India. Scheduled onstream: 1985.
- State Industrial Development Corp. of Kerala (south India): Holtec Engineers has been retained by the corporation for the engineering of a new 1,200 mtpd cement plant to be built at Walayar in the Palghat district.
- Shree Cement, Beawar: F.L. Smidth & Co., Denmark, and Larsen & Toubro, India, are to supply main and auxiliary machinery for an 1,800 tpd cement plant at Beawar. The main machinery comprises a No. 37.5 Atox raw grinding mill, 3.95 × 56m precalciner kiln with Folax Cooler and Atox coal grinding installation.
- Avarpur Cement, Chanda: Erection of the 3,200 tpd cement plant now being built under a cooperative agreement between F.L. Smidth and Larsen & Toubro is well underway. The plant will be the largest in India and will incorporate the latest in technology. The major machinery is of F.L. Smidth design and includes a TUM raw grinding plant, 4.55 × 68m precalciner kiln with Folax grate cooler, Tirax coal grinding installation, and two 4.2 × 12m Combidan cement grinding mills with double drive. Sundry main FLS equipment comprises CF-raw meal silo, 60,000 ton circular clinker store, and longitudinal stores for coal and gypsum. Dedusting in FLS electrostatic precipitators. The FLS order includes supervision and commissioning, besides running in the advanced, computerised process control system.
- Narmada Cement Co. Jafarabad: For a new plant Fuller Co. supplied following equipment: 15 ft. × 220 ft. rotary kiln; SF-141 flash calciner (3,000 mtpd); 12½ ft. × 45 ft. finish ball mill; two raw roller mills; coal roller mill; grate clinker cooler. Onstream in 1982.
- Hetauda Cement Industries Ltd.: New 260,000 mtpy dry process plant to be built at Hetauda (west of Kathmandu), Nepal. Consulting engineers: Prospective Engineering Gestion.
- Birla Jute Manufacturing Co. Ltd. has placed an order with Larsen & Toubro and F.L. Smidth for an extension to their Patna plant. The new installation will comprise a 2,500 mtpd dry process production line with precalcining kiln, raw grinding department, raw meal homogenizing plant, kiln department, and coal grinding plant.
- Cement Corp. of India Ltd.: Installed three 1,200 tpd dry process units at Neemuch, Akaltara, and Yerrguntla Himachal Pradesh (southern region). Engineering consultants: Holtec Engineering.
- Andhra Cement Co., Ltd.: New dry process 1,200 tpd plant at Nadikudi in the Guntur district of Andhra Pradesh. Consultants: Techno Craft Engineering.
- Tadpatri Cements Ltd.: New 400,000 tpy plant at Tadpatri. Consultants: Techno Craft Engineering Ltd. Scheduled onstream in 1984.
- Raasi Cement Co. Ltd.: New 200,000 tpy cement plant at Wazeerabad in the Nalgonda district of Andhra Pradesh. Consultants: Techno Craft Engineering.
- State Industrial Development of Orissa, India has retained Holtec Engineers for engineering a proposed 130,000 tpy expansion of its Hira cement plant which has a current capacity of 396,000 tpy. Scheduled for completion in 1982.
- Deccan Cements Ltd. Nalgonda district of Andhra Pradesh: Holtec Engineers will build a small scale, 200 tpd capacity plant scheduled to go onstream in 1982.
- Shri Bhogeshwara Cement and Mineral Industries Ltd., Kurnool district of Andhra Pradesh: Holtec Engineers will build a small scale, 200 tpd capacity plant scheduled to go onstream in 1982.
- Karnataka Cement Ltd.: Holtec Engineers have prepared a feasibility study for setting up a 200 tpd plant (rotary kiln with suspension preheater) in Gulbarga district of Karnataka.
- The Associated Cement Cos. Ltd. Wadi Cement Works being expanded by 1 million mtpy with installation of a new precalciner kiln; due onstream by 1982. Precalciner is a Mitsubishi fluidized unit.
- The Associated Cement Cos. Ltd., Gagal (in Himachal Pradesh): New plant being set up with capacity of 560,000 mtpy. Will use Mitsubishi fluidized calciner system and coal as fuel. Major equipment for both plants will be supplied by ACC-Vickers-Babcock Ltd. Gagal plant scheduled for operation in 1982.
- Saurashtra Cement and Chemical Industries, Ltd., Ranavav, Gujarat: Plant modernization scheduled for 1982 startup. Major equipment to be supplied by Fuller includes SF-135 preheater with flash calciner rated at 2,500 mtpd; 14 ft. × 200 ft. rotary kiln; Fuller-Loesche raw grinding mill; Airmerge blending system; reciprocating grate cooler; clinker breaker; Fuller-Kinyon pumps.
- Jammu and Kashmir Cements Ltd., Kashmir: New plant includes two 300 mtpd, 3m × 40m dry process kilns with planetary-type coolers. Design and engineering services performed by The Kuljian Corp. U.S.A. and Development Consultants International

Ltd., including construction supervision and final commissioning.

Indonesia

- PT Semen Kupang: Awarded contract to Leosche GmbH for the turnkey supply, erection, and operation of a 120,000 tpy vertical cement kiln plant for the Island of Timor.
- PT Perkasa Ini Abadi Indonesia Cement: Awarded contract to Polysius SA (France) for two production lines with a total capacity of 3 million tpy. Each plant is rated at 4,750 tpd. The new plant will be located in the district of Begor at Citeureup-Cibinung (45 km southeast of Jakarta). Major equipment to be supplied includes two primary crushers, one secondary crusher, a Poldos feed system, two 5.4m × 78m Dopol kilns, two tube mills for clinker grinding, eight rotary packing machines, programmable control system, and automatic Polab III laboratory automation system. Scheduled onstream in mid-1984.
- PT Semen Madura: New 2 million tpy plant, using two precalciner/preheater kilns, scheduled for operation in 1986 on Madura Island (opposite Surabaya, East Java).
- P.T. Perkasa Indonesia Cement Enterprise (Indocement Group), Cibinong, West Java: Adding a 3,200 tpd dry process production line. Major equipment suppliers are KHD Humboldt Wedag and Centunion (Spain). Production will be based on the Pyroclon process, using a 70 × 4.6m rotary kiln and a Humboldt twin-type preheater with secondary firing. Scheduled operation: 1981. A sixth production line with a 4,600 tpd output has been commissioned.
- P.T. Semen Padang: New 2,000 tpd plant built at Indarung, western Sumatra. Major equipment, furnished by F.L. Smidth, includes one 2,000 tpd, 16½ ft. × 263 ft. rotary kiln with four stage cyclone preheater and Unax planetary cooler; 16 ft. × 28 ft. raw mill; 14½ ft. × 39 ft. finish mill. Bendy Engineering Co. and H.K. Ferguson International Co. were consulting engineers. H.K. Ferguson is technical consultant for construction and startup. Onstream in 1980. A 2,000 mtpd extension, scheduled for operation in 1984, is now underway. Holtec Engineers of India will provide engineering consultancy services to the Indian Consortium of Projects and Equipment Corp. of India Ltd. (PEC) and Walchandnagar Industries Ltd. (WIL).
- P.T. Semen Andalas Indonesia has awarded the Mitsubishi Corp.-Kobe Steel consortium a contract to construct a 1 million tpy cement plant in Lho Gna, Banda Aceh, (in the northern part of Sumatra). Plant is scheduled to go onstream in early 1983. Will incorporate the NSP suspension preheater system developed jointly by Kobe Steel and Nihon Cement Co. Kobe Steel will supply engineering, equipment, and field construction. Blue Circle Industries will provide management and operation of the new plant.
- P.T. Semen Tonasa: F.L. Smidth has signed a contract with Coutinho, Caro & Co. for supply of rotary kiln and cement mill. The four-stage cyclone preheater kiln, 4.75 × 75m, will have an output of 1,900 tpd; the UM 4.4 × 12m cement mill with side drive and two 1900 kW motors will have a guaranteed output of 100 tpd.
- P.T. Perkasa Agung Utama Indonesia Cement Enterprise: KHD Humboldt Wedag and Centunion (Madrid) have received award to build a 4,600 tpd plant. Major equipment includes 5 × 78m rotary kiln; twin type Pyroclon preheater; Humboldt Wedag triple grate cooler. Scheduled for mid-1983 operation.
- P.T. Semen Tonasa (Biringere Cement Complex), South Sulawesi: New 590,000 mtpy dry process production line will be added to double existing capacity. Scheduled onstream in 1984. Dyckerhoff Engineering GmbH is responsible for consulting engineering including supervision of activities on the site and commissioning of the plant.

Iraq

- SOIDAC (State Organization of Industrial Design and Construction), Samava, Muthanna Province: KHD Humboldt Wedag will furnish equipment for construction of 2 million mtpy turnkey plant. Each of two production lines producing 3,200 tpd clinker will be equipped with 64m long × 4.4m diam. kilns preceded by Pyroclon preheaters. First production line scheduled to go onstream in 1984.
- SOIDAC, Hit City (180 km west of Baghdad): A 1 million mtpy plant construction award given to Kawasaki Heavy Industries Ltd. and Marubeni Corp. The Kawasaki suspension preheater system will be used. Lafarge Conseils et Etudes is in charge of construction supervision.
- SOIDAC, Badoosh (26 km to the northwest of town of Mossoul): New IHI precalciner unit extension that adds 3,200 mtpd is scheduled for 1983 commissioning. Order given to Fives-Cail Babcock.

Israel

Nesher Cement Co., Ltd. is planning a 500,000 tpy plant to be built at Ramle (24 km east of Tel Aviv).

Japan (includes Ryukyu Islands)

- Chichibu Cement Co., Ltd., Chichibu No. 2 plant: First kiln conversion to 4,800 mtpd IHI-NSF coal-firing precalcining system. The 5.5 × 83m kiln started up in 1981.
- Chichibu Cement Co., Ltd., Chichibu No. 1 plant: Seventh kiln conversion to 2,050 mtpd IHI-NSF coal-firing precalcining system. The 3.9 × 54.8 kiln started up in 1981.
- Sumitomo Cement Co., Tochigi Works: First kiln conversion to 2,150 mtpd IHI-NSF precalcining system. The 3.5 × 66m kiln started up in 1981.
- Sumitomo Cement Co., Ako No. 1 Works: Third kiln was converted to 4,800 mtpd IHI-NSF precalcining system. The 4.7 × 80m kiln started up in 1981.
- Nittetsu Cement Co., Ltd., Muroran Works: Fourth kiln conversion to 2,900 mtpd IHI-NSF coal-firing precalcining system adding one cyclone preheater. The 4.2 × 61.7m kiln started up in 1981.
- Osaka Cement Co., Ltd., Kochi Works: Grate preheater replaced by IHI-NSF precalciner system to boost 5.3 × 100m kiln to 7,500 tpd. Operation started up in 1982.
- Tokuyama Soda Co., Ltd., Nanyo Works: The third kiln (5.7 × 110m) was remodeled into IHI-NSF precalciner system using coal firing. Startup in 1982.

Jordan

- Jordan Cement Factories Co. Ltd., Fuheis: Fifth kiln, onstream in 1979, boosted production to 1.1 million mtpy. The kiln is a Polysius Dopol preheater unit. A sixth kiln, rated at 3,000 mtpd, was scheduled for operation in 1982. The new unit will use the DD process suspension preheater developed jointly by Kobe Steel and Nihon Cement Co. Kobe Steel will provide engineering, equipment supply, and field erection work. The contract was awarded to the Mitsubishi Corp./Kobe Steel consortium. Holderbank Management and Consulting Ltd. provided consultant services.
- South Cement Co. Ltd., Rashadiya: Mitsubishi Corp. (with Kobe Steel Ltd. as prime subcontractor) has turnkey contract for new 2 million mtpy plant. Raymond Kaiser Engineers provided precontract engineering and are consultants through plant startup which is scheduled for February 1984 (first line) and August 1984 (second line). Equipment includes two 250 tph Pfeiffer roller mills; two 3,200 tpd suspension preheaters with DD precalciners of Nihon Cement/Kobe Steel design with 4.6×72m rotary kilns and reciprocating grate clinker coolers; four 3,300 kW Kobe/A-C Compeb finish mills.
- Arab Company for White Cement Industry, Khaldiya: New 300 tpd white cement plant scheduled for 1983 operation. Contractor: B.K.M.I. Industrieanlagen GmbH. W. Germany. Consulting engineers: Basse Sambre-E.R.I.

Korea (South), Republic of

- Union Corp., Seoul, has entered into a contract with F.L. Smidth covering the supply of machinery and electrical equipment for a new 300 tpd white cement plant to be erected at a site 200 km southwest of Seoul. The order comprises a 3.45×60m rotary kiln with a two-stage cyclone preheater, Unax cooler and heat exchanger, a Tirax raw mill, and a Unidan cement mill, both with a Symetro gear. Onstream in 1982.
- Tong Yang Cement (Seoul) has started an expansion program for its Sam Chok plant. Fuller Co. is supplying equipment, including 48×60 in. jaw crusher; 42 in. gyratory crusher; two 10 ft.×70 ft. rotary dryers; two 13 ft.×45 ft. raw mills; two 16 ft.×245 ft. rotary kilns with four-stage twin preheaters; clinker coolers; three 13 ft.×45 ft. finish mills; plus blending, conveying, and dust collecting equipment.

Malaysia

- Associated Pan Malaysia Cement, Kanthan: Replacing wet process kilns with four-stage preheater unit. Capacity to remain 500,000 mtpy. KHD Humboldt-Wedag (France) will supply the equipment. Blue Circle Industries is technical planning consultant. Scheduled onstream in 1984.
- Associated Pan Malaysia Cement, Chemor (90 miles north of Kuala Lumpur): Modernizing by converting from wet process to dry process.
- Associated Pan Malaysia Cement: On site of existing Rawang plant, new 4,000 mtpd plant with IHI-NSF oil shale-firing precalcining system incorporating five-stage preheater started up in 1981.
- Bukit Sagu: Lafarge Conseils et Etudes has prepared a feasibility study for a new 500,000 mtpy cement plant.
- Kedah Cement Sdn. Bhd., Pulau Langkawi, Kedah State: New coal-fired plant rated at 4,000 tpd has been ordered. IHI (Ishikawajima-Harima Heavy Industries Co. Ltd) will undertake construction work on a turnkey basis. The IHI-NSF sintering process will be used. Scheduled onstream in 1984.
- Perak-Hanjoong Simen Sdn. Bhd.: Raymond Kaiser Engineers is serving as owner's representative for a 1.2-million-mt plant. Turnkey contractor is Korea Heavy Industries Construction Co., Ltd. Startup scheduled for 1985.

Nepal

- Indo-Nepal cement plant: Engineers India Ltd. has prepared a report for a 3,000 tpd dry process precalcinator plant to be set up in eastern Nepal. The plant will be owned jointly by the governments of India and Nepal.
- Hetauda Cement Industries Ltd., Hetauda (125 km south of Kathmandu): New 260,000 tpy plant equipped with a preheater kiln is scheduled for mid-1983 operation. Contract awarded to Onoda Engineering & Construction Co. Prospective Engineering Gestion (Switzerland) is technical consulting firm, and Development Consultants is engineering contractor.

Oman, Sultanate of

- Oman Cement Co., Rusayl (near Muscat): Krupp Polysius will construct turnkey cement plant with a capacity of 2,000 mtpd. Consulting engineers are Basse Sambre-E.R.I. Startup scheduled: 1984.
- Raysut Cement Co., Salalah, Province of Dhofar: New 210,000 mtpy plant with a four-stage preheater is scheduled to go onstream in 1983. Contract for equipment supply and plant erection was awarded to Babcock Krauss-Maffei Industrieanalagen. Holderbank Management and Consulting Ltd. is the consulting engineer.

Pakistan

- Mustehkam Cement Ltd.: Added a 300,000 tpy dry process, one kiln unit. KHD Humboldt Wedag supplied the major equipment.
- Javedan Cement Ltd. (State Cement Corp. of Pakistan), Javedan: Adding a 300,000 tpy dry process, one kiln unit. Fuller Co. supplying major equipment, including 13½ ft.×190 ft. rotary kiln with four-stage preheater; 12 ft.×26 ft. raw mill; 12 ft.×37 ft. finish mill; grate clinker cooler; Plenum-Pulse dust collectors.
- Pak-Iran Cement: New 300,000 tpy plant, scheduled for 1981 operation, in Darwaza (Baluchistan).
- Early in 1979, the government of Pakistan engaged the joint venture of Bendy Engineering Co., USA, and Industrial & Cement Engineering, Ltd., Pakistan, to prepare a feasibility study for the establishment of a new cement plant near Nizampur in Pakistan.

Philippines

- Davao Union Cement Corp. Mindanao: Contract awarded to F.L. Smidth and Mitsui Co. for turnkey supply of a 1,250 mtpd cement plant. Main machinery will include an Atox mill; a CF (controlled flow) silo; a 3.75×53m precalciner kiln with Folax grate cooler; a coal crusher; a 4×28×

Saudi Arabia: Southern Province Cement Co. (Gizan). Plant designed with two manufacturing facilities, each rated at 2,500 mtpd; onstream in 1982. Pyroprocessing units are Fuller preheater/flash calciner kilns. *(Courtesy: Basse Sambre-E.R.I., SA).*

3.4m Tirax raw mill; a 3,300 kW finish mill.

- APO Cement Corp., Cebu Island: Asland has signed an agreement for expansion of existing 130,000 tpy wet process plant.

Qatar

- Qatar National Cement Co., Doha: Belgium consultants Basse-Sambre-E.R.I. have been awarded a contract for construction of a 2,000 mtpd plant to be built at Umm Bab. This will be an extension of existing facilities.

Saudi Arabia

- Saudi White Cement Co. intends to establish a 200,000 tpy white cement plant near Riyadh. Raw material investigations and basic engineering have been carried out by Holderbank Management and Consulting Ltd. A contract for the execution of the works was expected to be signed before the end of 1982.
- Qassim Cement Co.: A consulting agreement with Holderbank for the extension of the existing cement plant in Buraydah was concluded. It comprises raw material investigations, a feasibility study, elaboration of tender documents, and site supervision.
- Saudi-Bahraini Cement Co., Abqaig (about 100 km west of Dammam): New plant with four 1,500 mtpd kilns went into operation in 1981. Project was carried out by Ishikawajima-Harima Heavy Industries Co. Ltd. Holderbank Management Consulting was the consultant.
- Arabian Cement Co., Rabigh (180 km north of Jeddah on the Red Sea coast): New cement plant with four production lines rated at 4,000 tpd clinker scheduled for mid-1984 operation. KHD Humboldt Wedag will be major equipment supplier.
- The Saudi-Kuwaiti Cement Manufacturing Co., Riyadh, has awarded Krupp Polysius the contract to build Saudi Arabia's largest cement facility near Khursaniyah, 100 km north of Dammam. The plant consists of two production lines with total clinker capacity of 7,000 tpd.

Equipment to be supplied includes several crushing and blending units, stocking facilities, two Dopol kilns with Prepol-AS precalcining, complete electrical system, process, laboratory and dispatch automation, and water supply system with desalination plant.

Assembly of the complete plant is scheduled for 1983 and commissioning for the end of 1984.

- Southern Province Cement Co.: New 5,000 mtpd plant erected at plant site 35 km east of the Red Sea, 60 km southeast of the city of Gizan, and 11 km from the Yemen border. The joint venture turnkey contract was awarded to the Fuller Co. and Hyundai International, Inc. (Korea). Consulting firm was Basse Sambre-E.R.I., S.A. The plant has been designed with two cement manufacturing systems side by side, each with a capacity of 2,500 mtpd. Major equipment by Fuller, incorporated in the process, includes two 42 in. gyratory crushers, two 6,000-hp, 15 ft. × 42 ft.-long ball mills, a blending and kiln feed system, two 14½ ft. × 210 ft.-long kilns, two preheaters with flash calciners, two clinker coolers, as well as two 7,000-hp, 15 ft. × 48 ft.-long finish mills. Start-up: 1982.
- Yamama Saudi Cement Co., Riyadh: Extension of existing facilities by addition of a 1,500 tpd dry process Krupp Polysius kiln unit. Consulting engineers: Basse Sambre—E.R.I. Onstream in 1982.
- Yanbu Cement Co. Ltd.: New plant to be built near Ra's Baridi (at the Red Sea). Contract for construction was issued to KHD Humboldt Wedag AG. Plant has two production lines with daily output of 3,000 tons of clinker. Onstream in 1980. Third 1,000 tpd line is scheduled for 1984 operation. KHD Humboldt Wedag will be supplier.
- Yanbu Cement Co. and Arabian Cement Co., both of Jidda, have awarded a consulting job for planning, construction, and equipment installation for two new cement plants to Naigai Consulting Co., subsidiary of Onoda Cement Co., Japan. The mills will be built near Jidda and have a production capacity of 1 million tpy. KHD Industrieanlagen Humboldt Wedag is the major equipment supplier.

Sri Lanka

Sri Lanka Cement Corp.: Kankesanturai cement works being modernized and expanded. KHD Humboldt Wedag will furnish a single-line Humboldt preheater system for a 1,600 mtpd first extension, and Pyroclon process with secondary firing for the second 1,600 mtpd extension. Holtec Engineers of India is providing the engineering services. Scheduled onstream in 1983.

Syria (Syrian Arab Republic)

- General Organization for Executing Industrial Projects, Government of Syria, made plans, in the '70s, for a chain of 12 dry process production lines. Seven kilns have been placed onstream. The remaining kilns are expected to go on line by mid-1983. Project consultants are The Kuljian Corp. (U.S.A.) and Development Consultants International Ltd. (Hong Kong) for engineering, design, construction supervision, and commissioning arrangements.

- Adra cement plant: New plant onstream in 1980 includes three 1,000 mtpd kilns, each 4×60m with shaft-type preheaters.
- Tartous cement plant: New plant onstream in 1981 includes four 1,600 mtpd 4.6m×69m kilns with shaft-type preheaters. Suppliers: SKET, GDR.

Thailand

- Siam Cement Co. Ltd., Ta Luang: New 4,000 mtpd production line expansion onstream in 1981. The main machinery, supplied by F.L. Smidth, includes 3050 kW Duodan raw mill; a homogenizing plant; a 4.75×75m rotary kiln with four-stage cyclone preheater and separate precalciner string; Folax cooler with electrostatic precipitator; three 4230 kW Unidan finish mills.
- An existing production line at Ta Luang also is being expanded. Main machinery, to be supplied by F.L. Smidth, includes a 3050 kW Duodan raw mill; an homogenizing plant; conversion of a 1,500 mtpd wet process kiln to a 4,000 mtpd dry process kiln with cyclone preheater and separate precalciner string; and a Folax cooler with electrostatic precipitator.
- Siam City Cement Co. Ltd., Tabkwang, Saraburi (about 130 km from Bangkok): New 4,000 mtpd plant onstream in 1981. Main machinery, supplied by F.L. Smidth, included 4.75×75m rotary kiln with four-stage cyclone preheater and separate precalciner; Folax cooler; two raw mills; two cement mills.
- Siam City Cement Co. Ltd., Saraburi: Krupp Polysius is supplying a second preheater Dopol kiln with Prepol-AS precalciner to increase capacity from 1.52 million to 2.17 million mtpy. Scheduled on line in 1983.
- Thai Lanna Cement Co.: Planning 2,300 tpd plant in the Lampang area that was to go into operation by 1982.

United Arab Emirates (Abu Dhabi, Dabai, Sharja, Ajman, Fujaira, Umm al Qaiwan, Ras al Khaima)

- Gulf Cement Co., Ras al Khaimah: New 1 million mtpy cement plant to be built by UBE Industries of Japan. The W.S. Atkins Group will act as consultants for design and on-site supervision of construction. The project will utilize the UBE flash calciner system. Kiln is 4.4×75m; two raw mills each being 4.1×11.5m; two finish mills are 4.1×11.5m each. Scheduled onstream in 1981.
- Al-Ain Cement Factory, Al-Ain, Abu Dhabi: New 1,800 mtpd plant, onstream in 1981, uses the IHI (Ishikawajima-Harima Heavy Industries Co., Ltd.) SF-type cement sintering system. Holderbank Management & Consulting Ltd. was consultant for planning and implementation of the project. This second production line brings total capacity to 2,400 mtpd.
- Emirate of Fujairah has awarded a construction contract to Voest-Alpine for a 1,600 tpd dry process plant. Raymond Kaiser Engineers are the consultants on the project. Scheduled onstream in 1983.

Vietnam

- Technoimport has contracted with F.L. Smidth to supply equipment for a new 3,100 tpd plant at Hoang Thach near Dong Trieu. Equipment includes a 775 tpd crusher, blending and storage equipment for 43,000 tons of raw materials, an 18½ ft.×23 ft., 3900-kW finish mill, an 18 ft.× 293 ft. kiln with four-stage twin preheaters and planetary cooler; a 6,500-kW finish mill, 17 ft.×46 ft.; and equipment for dispatch of cement in bulk and sacks. The system further includes equipment for advanced computerized control systems.
- Cimenterie de Ha Tien, Kien-Luong plant: Technoimport has awarded a contract to French subsidiary of Polysius AG for addition of a Dopol kiln, complete with a precalcining system and auxiliary equipment. The kiln has a capacity of 1 million tpy and was scheduled for 1980 operation. Major equipment includes: one precalcining system rated for 3,000 mtpd with 4.8×60×89.5m kiln with planetary coolers; one 4,500-hp air-swept raw mill, 5.2×11m, rated for 240 mtph; two 4,200-hp cement mills, each 4.2×14m, rated for 90 mtph.

Yemen (Yemen Arab Republic)

- Cement plant is to be constructed at Bajil (near Hodeida) with a capacity of 200,000 tpy.
- A 1,500 tpd dry process plant scheduled for 1982 operation near Amran. IHI (Japan) will supply engineering and equipment procurement and handle construction.

OCEANIA: Cement Production—1978-81

	1978	1979	1980	1981*
Australia	5.013	5.350	5.560	5.30
Fiji Islands	.088	.087	.083	.09
New Caledonia	.050	.050	.050	.06
New Zealand	.800	.752	.828	.75
Papua New Guinea	—	—	—	n.a.

**Preliminary*
n.a. . . . not available at time of writing
Quantities in million metric tons (tonnes)
1 tonne=1.10231 short tons

OCEANIA

Australia

- Goliath Portland Cement Co., Ltd., Railton, Tasmania: Plant expansion, using Humboldt Wedag Pyroclon precalcination preheater system, will double plant's production to 1 million mtpy. Scheduled for 1981 operation.
- Queensland Cement and Lime Co. Ltd., Gladstone (Queensland): New 500,000 mtpy plant went onstream in 1981. Plant features a 24-km long slurry pipeline, pressure filtration of the slurry, rotary dryer for production of raw meal from filter cakes, a four-stage preheater kiln with grate-cooler operated in duotherm circuit. Clinker is loaded into seagoing vessels at 2,000 mtph rate. Main consultants were Holderbank Management and Consulting Ltd., and Crooks, Michell, Peacock and Stewart Pty. Ltd. (Sydney). Most equipment was supplied by Noyes Brothers, Sydney.

New Zealand

Wilsons (NZ) Portland Cement Ltd., Auckland: Converting from wet process to dry suspension preheater process. Capacity: 400,000 mtpy. Scheduled onstream: 1982.

EUROPE: Cement Production—1978-81

	1978	1979	1980	1981*
Albania	.750	.800	.900	1.00
Austria	5.61[illegible]	5.460	5.389	5.40
Belgium	7.576	7.700	7.483	7.50
Bulgaria	5.149	5.402	5.364	5.44
Cyprus	1.107	1.152	1.283	1.20
Czechoslovakia	10.224	10.258	10.548	10.65
Denmark	2.537	2.222	1.795	1.54
Finland	1.718	1.750	1.778	1.79
France	31.175	31.230	30.562	28.23
Germany-East (German Democratic Republic)	12.521	12.273	12.440	12.50
Germany-West (Federal Republic of Germany)	32.993	34.700	33.134	33.03
Greece	11.333	12.098	12.560	13.50
Hungary	4.764	4.857	4.660	4.64
Iceland	.133	.127	.131	.12
Ireland	1.795	2.049	1.869	1.77
Italy	38.493	39.484	41.932	42.00
Luxembourg	.935	.891	1.051	1.10
Netherlands	3.918	3.715	3.782	3.80
Norway	2.339	2.362	2.206	1.78
Poland	21.651	19.180	18.444	14.22
Portugal	5.163	5.379	5.830	5.70
Romania	13.892	14.656	16.000	14.75
Spain (includes Canary Islands)	32.064	29.315	29.630	28.60
Sweden	2.370	2.340	2.543	2.32
Switzerland	3.698	3.934	4.252	4.30
Turkey	15.409	13.900	12.910	14.00
United Kingdom	16.564	16.240	14.916	13.26
U.S.S.R.	129.3	123.0	124.8	127.01
Yugoslavia	8.642	9.029	9.312	9.78

**Preliminary*
n.a. . . . not available at time of writing
Quantities in million metric tons (tonnes)
1 tonne=1.10231 short tons

EUROPE

Austria

Voralberger Zementwerke Loruns AG, Bludenz: replaced a wet process kiln with a KHD Humboldt Wedag preheater kiln plant. The new clinker production line includes four-stage Humboldt preheater; 2.8×23m rotary kiln; 2.25×23m tube cooler. Kiln capacity rated at 260 tpd. Onstream in 1981.

Germany-West (Federal Republic of Germany)

- Spenner Zement KG, Erwitte: At Diamant cement plant, a new 750,000 tpy cement production line was placed in operation in 1981. Pyroprocessing equipment includes a short 4m diam. kiln, five-stage KHD Humboldt-Wedag preheater, and 4.8m×47m tube cooler. Brown coal dust is used for firing.
- Dyckerhoff Zementwerke AG: Modifying clinker production line of Fortuna plant at Geseke by installing a KHD Humboldt Wedag Pyroclon preheater system to increase production from 800 to 1,500 mtpd. Onstream in 1981.
- Dyckerhoff Zementwerke AG, Lengerich plant: Installed Polysius Prepol preheater with precalciner/kiln, rated at 1,650 mtpd. Onstream in 1981.

Greece

- Halyps Cement Co. S.A., Paralia Aspropyrgou: The 1,500 mtpd 4.4m×67m kiln and suspension preheater supplied by Fives-Cail Babcock went onstream in 1981.
- Heracles General Cement Co. S.A.: Planning 1.5 million mtpy plant at Milaki in Euboea to replace Piraeus plant. Scheduled onstream in 1982. Equipment supplied by F.L. Smidth includes 4.75×75m, 4,000 mtpd precalciner kiln with Folax grate cooler; MPS 4850/3150 raw mill; 3.2×6m plus 2.4m Tirax coal mill; two 5×14m finish mills with Symetro gear units.
- Heracles General Cement Co. S.A., Volos cement plant: Converting production lines four and five to the KHD Humboldt Wedag Pyroclon process. Clinker production of line four, equipped with a single-line Humboldt preheater, increased from 1,700 to 2,100 mtpd; that of kiln line five, with a two-line preheater, increased from 2,300 to 3,000 mtpd.

Ireland

- Irish Cement Ltd., Limerick plant: Adding 2,100 tpd capacity. F.L. Smidth supplying main equipment, including 4.75×75m rotary kiln with four-stage cyclone preheater with calciner in the riser pipe; Unax cooler; raw mill; two cement mills; one coal mill installation; and electrostatic precipitators. Scheduled on line in 1983.

Italy

- Unicem S.A., Arcangelo: Plant conversion begun in 1980. Adding 600 tpd Polysius Lepol kiln with preheater grate and Recupol cooler.
- Cementizillo, Fanna: One kiln conversion to Polysius Dopol preheater kiln rated at 2,200 mtpd. Ordered in 1981.
- Cementi Piave, Pederobba: One kiln conversion to Polysius Prepol AS precalciner kiln, rated at 2,640 mtpd. Ordered in 1981.
- Cementerie Aldo Barbetti, Gubbio: F.L. Smidth has received an order for a 1,500 tpd installation, comprising a 4.55×68m cyclone preheater kiln with Folax cooler.

Luxembourg

ARBED Luxemburg steel group planning new cement plant in Rumelange in joint venture with Ciments de France. Scheduled for 1984 operation.

Portugal

- Secil Companhia General de Cal e Cimento, Setubal plant: Adding new 3,500 mtpd production line. F.L. Smidth is supplying 95m dia. circular store for limestone; CF homogenizing and storage silo; four-stage, 5.25×83m kiln with Unax cooler and riser duct calciner; Atox coal mill; FLS-725 central control system. Scheduled onstream in 1983.

Spain (includes Canary Islands)

Cementos Portland S.A., Ollazagutia: Conversion to Fuller SF process via a 1,800 mtpd flash calciner plus cooler expansion. Start-up: 1981.

Sweden

Cementa AB: Added 4,700 mtpd production equipment to its Slite plant (on Gotland Island). Polysius Corp. supplied major equipment, including 2,400 hp double roller mill rated at 400 mtph; 4.6 × 5.2m-diameter × 80m-long rotary kiln with precalcining and cyclone preheater unit; two 6,000 hp, 4.8m × 15.5m cement mills, each rated at 120 mtph; homogenizing system.

Turkey

- The Aslan plant of Aslan ve Eskihisar Muttahit Cimento ve su Kirechi Fabrikalari A.S. has planned expansion of capacity from 480,000 to 1 million mtpy.
- Further expansion of cement production is planned in Turkey. The Cisan (Turkiye Cimento Sanayee T.A.S.), the Turkish national cement enterprise, has placed an order with KHD Humboldt Wedag for the erection of seven cement plants. All plants will be dry process systems using Humboldt preheaters. The plants will be built according to one concept, retaining the same plant dimensions. Their clinker production will average about 1,750 mtpd with slight variations due to the different altitude levels of the plants and different raw materials deposits. Engineering consultants: Dyckerhoff Engineering GmbH. The first plants are scheduled to become operational during the first half of 1983.

United Kingdom

- Ribblesdale Cement Co. Ltd., Lancashire, England: Plant extension. F.L. Smidth supplying main equipment, including circular raw material storage; raw mill; 2,300 tpd single-string suspended preheater with precalciner; 4.15 × 58m kiln with bypass; Folax grate cooler; two conditioning towers; and three electrostatic precipitators. Onstream: 1982.
- Blue Circle Industries PLC. Cauldron Works, Stoke-on-Trent, Staffordshire: One of the plant's three kilns to be converted from a Lepol grate to an air suspension precalcining process. The three existing raw mills will be replaced by one modern mill. When conversion is complete, the remaining two kilns will be shut down.
- Blue Circle Industries Ltd., Northfleet, Kent: Converting two wet process kilns to semi-dry process. Scheduled onstream in 1983.
- Blue Circle Industries Ltd., Shipton-on-Cherwell, near Oxford: Planning new dry process plant for potential operation in 1984.
- Blue Circle Industries Ltd., Shoreham: Two existing wet process kilns being converted to a semi-dry process. Scheduled completion was 1982.

U.S.S.R.

No data available.

Yugoslavia

- Pragoinvest (Czechoslovakia) has a contract for a 2,200 mtpd cement plant to be located at Bela Palanka. Equipment to include a 4.8 × 72m kiln with semicalcination system and planetary coolers, a 4.8 × 13m raw mill, and two 4.2 × 13m finish mills.
- Fabrika Cementa Nov Popovac: Expanding Popovac plant with a 2,000 mtpd addition. Major equipment, being supplied by F.L. Smidth and Pragoinvest, includes 16½ ft. × 263 ft. precalciner rotary kiln equipped with four-stage cyclone preheater and Unax planetary cooler; 16 ft. × 27 ft., 2,800kW raw mill; 16 ft. × 46 ft., 5,160kW finish mill. Onstream in 1982.
- Extension of Kosjeric plant situated about 150 km southwest of Belgrade. In cooperation with the Czechoslovakian firm, Pragoinvest, F.L. Smidth is supplying the following major equipment: 825 tpd crusher; circular prehomogenizing storage for limestone; 1,600 kW raw mill; 4.15 × 58m precalciner kiln with four-stage preheater and Folax cooler; two 4.4 × 12m Combidan cement mills; 4 × 5m Tirax coal mill; portal scraper storage; automatic control equipment. The new production line will add 2,200 tpd capacity.
- Istarske Tvornice Cementa I Hidratiziranog Vapna, Pula: Installed one Polysius Gepol kiln for white cement production. Capacity: 220 mtpd. Onstream in 1981.
- Fabrika za Cementi Usje, Skopje: Kiln conversion to Polysius Dopol preheater unit rated at 1,430 mtpd. Onstream in 1981.

NORTH AMERICA

NORTH AMERICA: Cement Production—1978-81

	1978	1979	1980	1981*
Canada	10.473	11.080	10.019	10.37
United States of America	73.826	74.555	66.821	63.643

**Preliminary*
Quantities in million metric tons (tonnes)
1 tonne = 1.10231 short tons

Canada

- Canada Cement Lafarge Ltd.: Expanding plant at Exshaw, Alberta, to add 600,000 tpy. Equipment includes F.L. Smidth gas-fired 3.95 × 56m kiln, rated at 1,950 mtpd and equipped with a four-stage preheater with precalciner; Fuller 3.96 × 12.62m, 3,700 hp, two-compartment raw mill; F.L. Smidth 4.60 × 14.02m, 6,000 hp finish mill; Fuller clinker cooler; Wheelabrator electrostatic precipitator; Fuller-Kinyon conveying equipment. Onstream in 1981. Lafarge Consultants Ltd. were the engineering consultants for the expansion.
- Ciment Quebec, Inc., St. Basile de Portneuf, Quebec: Plant expansion will replace existing 1,100 tpd wet process plant with a Fuller SF system rated at 2,000 tpd. Fuller Co. is furnishing major equipment, including four-stage preheater with flash calciner; cooler; Fuller-Loesche airswept roller mill; blending equipment; Airslide conveying equipment; Fuller-Kinyon pumps; and dust collectors. Scheduled onstream in 1981.
- St. Lawrence Cement Co., Mississauga, Ontario: Expanded via a Fuller SF flash calciner to increase production from 3,000 to 4,500 mtpd. Added cooler section and new kiln drive. On line in 1981.

United States of America

U.S. developments are covered on page 51 in this issue.

CENTRAL AMERICA: Cement Production—1978-81

	1978	1979	1980	1981*
Bahamas	.635	.600	.400	.60
Barbados (see Trinidad and Tobago)	—	—	—	n.a.
Costa Rica	.426	.527	.545	.50
Cuba	2.712	2.700	2.800	3.25
Dominican Republic	.873	.900	.991	.98
El Salvador	.530	.587	.650	.50
Guadeloupe	.162	.143	.144	n.a.
Guatemala	.636	.573	.575	.45
Haiti	.249	.237	.243	.25
Honduras	.271	.231	.445	.50
Jamaica	.294	.225	.144	.15
Martinique	.131	.144	.180	n.a.
Mexico	15.285	15.178	16.260	17.00
Nicaragua	.199	.100	.100	.10
Panama	.300	.524	.565	.60
Trinidad and Tobago	.220	.220	.180	.20

**Preliminary*
n.a. . . . not available at time of writing
Quantities in million metric tons (tonnes)
1 tonne = 1.10231 short tons

CENTRAL AMERICA

Bahamas

Barbados (see Trinidad and Tobago)

- Arawak Cement Co., created as joint venture between the Barbados government and the Trinidad & Tobago government, has started construction of a 1,000 mtpd cement plant on the west coast of Barbados. Scheduled for mid-1984 startup, the project is on a turnkey basis from Voest-Alpine of Austria. Holderbank Consulting Ltd. is responsible for the project supervision on behalf of the Barbados government.

Costa Rica

- Cementos del Pacifico (subsidiary of Corporacion de Desarrollo): New 1,300 mtpd cement plant onstream in 1980 in the province of Guanacaste (75 miles west of San Jose). Allis-Chalmers and Ateinsa (Spain) provided equipment and technical services. The contract included an Allis Chalmers roller mill with 1,750 hp drive motor; suspension preheater; 14 ft. × 197 ft. rotary kiln; 8 ft. × 22 ft. inclined/10 ft. × 41 ft. horizontal stoker cooler; 13 ft. × 42 ft. finish grinding Compeb mill with a 4,000 hp motor. Asland S.A. (Spain) provided staff training and start-up assistance.

Cuba

Desarrollo Industrial; Rene Arcay Cement works, Mariel: Expansion onstream in 1981, doubled capacity to 4,400 tpd. Humboldt Wedag furnished a two-shaft hammer crusher rated at 900 tph limestone. Engineering was provided by KHD Industrieanlagen AG in cooperation with Centunion (Madrid). In addition, a ship-loading installation is being built.

Haiti

Lafarge Consultants Ltd., Montreal, has signed a contract with the Department du Commerce et de l'Industrie of the Republic of Haiti to complete the preparation for the construction of a new cement plant in Gonaives.

Honduras

Industria Cementera Hondurena, S.A., Piedras Azules (north central Honduras): New plant for production of 1,200 mtpd of clinker plus more than 500,000 mtpy of portland and pozzolanic cement. Onstream in 1981. Kawasaki-Itoh furnished main equipment, including Kawasaki-Hazemag 300 mtph crusher; 4.4 × 9m raw mill; 1,200 mtpd kiln with four-stage preheater and satellite cooler; and 46 mtph finish mill. Technical assistance was provided by Asland SA (Spain).

Jamaica

Caribbean Cement Co. Ltd. Expanding its Kingston plant with a 1,300 mtpd installation. Major equipment, being supplied by Allis-Chalmers, includes a 14 ft. × 197 ft. rotary kiln with a suspension preheater; a cooler with an 8 ft. × 22 ft. inclined section and a 10 ft. × 42 ft. horizontal section; and a roller mill.

Mexico

- Cemento Portland Nacional S.A. (Empresas Tolteca de Mexico S.A. group), Hermosillo, Sonora (plant is about 25 km from Hermosillo): New 1 million tpy plant went onstream in 1982. F.L. Smidth supplied major equipment and erected and commissioned the plant. Engineering was done by Blue Circle Industries which has a 49% share in the company. The main FLS equipment consists of a 4.35m-diameter × 66m kiln with single string, four-stage preheater and precalciner; Folax grate cooler; two 4.8m-diameter × 8.57m-long raw mills with 1800 B Symetro gears—all are arranged for closed-circuit grinding, crushing, and homogenizing. Smidth also supplied dedusting equipment and all auxiliary and electrical equipment, including instrumentation and control.
- Cementos Tabasco (div. of Cementos Apasco, Macuspana (60 km from Villahermosa), Tabasco: New 750,000 tpy dry process (precalciner kiln) plant, onstream in 1982. Consulting engineering and design by Holderbank Consulting Ltd. (Canada). Main equipment, supplied by F.L. Smidth, includes 2,200 mtpd kiln with a precalciner; 185 mtph airswept ball mill; 124 mtph cement mill.
- Cimentos de Chihuahua, S.A., Chihuahua, Chih.: Expanding plant by a 1,700 mtpd clinker line. Scheduled onstream in 1982. Main machinery being supplied by F.L. Smidth includes 4.8 × 9m Duodan mill with central Symetro drive; homogenizing system; four-stage preheater; 4.55 × 68m kiln equipped with Unax planetary cooler. Sereland (Spain) is in charge of design, equipment procurement, and supervision of the expansion.
- Cementos Mexicanos S.A., Valles, Est. San Luis Potosi: Cementos Mexicanos S.A. placed an order with F.L. Smidth for the main machinery for a 2,200 tpd expansion of their Valles plant. The equipment includes a 4.15 × 58m precalciner kiln with type 824S Folax cooler, a 4.6 × 7.6m, 2,200 kW raw mill, and a 4.6 × 14m, 4,400 kW cement, both with Symetros. Onstream in 1981.
- Cementos Mexicanos S.A., Monterrey, Est. Nuevo Leon: At the beginning of 1979, Cementos Mexicanos S.A. followed up their Valles expansion project with a similar extension of their Monterrey plant. The new kiln and associated raw mill and cement mill are identical to the F.L. Smidth Valles

equipment. Holderbank Consulting Ltd., Ontario, carried out basic conceptual work, equipment procurement, drawings, and process control engineering. On line in 1982.

- Cementos Mexicanos S.A., Torreon, Ets. Coahuila: Expanding plant with new 2,200 production line to be furnished by F.L. Smidth.
- Cementos Mexicanos S.A., Guadalajara plant: F.L. Smidth furnishing equipment for a new 2,200 mtpd production line expansion.
- Cementos Mexicanos S.A., Huichapan (130 km north of Mexico City): F.L. Smidth supplying major equipment for new 3,200 mtpd plant. Main machinery includes 5 × 11.75m plus 3.2m Tirax raw mill; CF homogenizing silo; 3,200 mtpd, 4.55 × 68m precalciner kiln with Folax cooler; two 4.6 × 14m Combidan finish mills; a packing plant.
- Cementos Maya (Cementos Mexicanos group), Guadalajara: New plant expansion of 2,200 mtpd is expected to be started up by first quarter of 1983. F.L. Smidth is supplying kiln and mills. Engineering is being done by C. Maya with the assistance of Holderbank Consulting Ltd. for the electrical and process control engineering.
- Cementos Vera Cruz S.A. (Empresas Tolteca de Mexico, S.A. group), Orizaba, Vera Cruz: Expansion was slated for mid-1981 operation. Installing one Polysius Prepo preheater with precalciner/kiln, rated at 2,400 tpd. Holderbank Consulting Ltd., Ontario, carried out engineering, design studies, and equipment procurement.
- Cementos Tolteca S.A., Zapotiltic: Expansion of 2,500 mtpd. Main equipment by F.L. Smidth includes two Tirax-Unidan 5.6 × 8.25m raw mills, 4,500 kW each; silo blending system; four-stage preheater with firing in riser pipe; 4.75 × 75m rotary kiln with Unax planetary cooler. This is a Blue Circle project. Scheduled onstream in 1983.

Guadalajara

- Cementos Guadalajara is expanding its plant by 2,200 tpd. F.L. Smidth is supplying the main equipment. Holderbank Consulting is performing the instrumentation and control engineering. Scheduled onstream in 1983.

Panama

Cemento Panama S.A. has awarded a contract to Lafarge Consultants for a feasibility study on the expansion and modernization of its plant.

Trinidad and Tobago

Trinidad Cement Ltd., Claxton Bay, Trinidad: New 1,000 tpd wet process plant was scheduled onstream in 1982. The Austrian company Voest-Alpine is providing the equipment on a turnkey basis. Raw material preparation and slurry storage facilities will be installed in the quarry. A high-pressure station will convey the slurry by pipeline to the cement plant which is located 16 miles from the quarry.

SOUTH AMERICA

SOUTH AMERICA: Cement Production—1978-81

	1978	1979	1980	1981*
Argentina	6.316	6.667	7.133	7.50
Bolivia	.203	.253	.254	.25
Brazil	23.203	24.874	27.193	28.50
Chile	1.176	1.353	1.567	1.60
Colombia	4.140	4.498	4.377	5.20
Ecuador	.834	1.008	1.039	1.45
Paraguay	.166	.155	.177	.19
Peru	2.165	2.428	2.770	3.08
Surinam	.056	.069	0.070	.06
Uruguay	.686	.689	.699	.69
Venezuela	4.150	3.999	4.841	4.90

**Preliminary*
n.a. . . . not available at time of writing
Quantities in million metric tons (tonnes)
1 tonne = 1.10231 short tons

Argentina

- Juan Minetti S.A.: New 540,000 mtpy plant in Malagueno, Cordoba was scheduled for operation in 1981. Major equipment, supplied by KHD Humboldt Wedag and cooperating partner Centunion (Spain), will include 4.4 × 64m rotary kiln; 4 × 13m, 2,790 kW clinker grinding mill rated at 100 tph. Technical assistance: Asland S.A.
- Juan Minetti S.A.: New 720,000 mtpy plant built at Puesto Viejo in Jujuy province (northern Argentina). Onstream in 1982. Equipment supplied by KHD Humboldt Wedag. Technical assistance by Asland. Pyroprocessing unit is a 4.4 × 64m preheater kiln.
- Loma Negra Compania Industrial Argentina, S.A., Olivarria: Expansion, onstream in 1981, includes modification of existing long, dry kiln to two-stage preheater unit; capacity increase from 1,200 mtpd to 1,600 mtpd; modification of existing Polysius preheater to precalcining; capacity increase from 2,400 to 3,500 mtpd; one 4,000 hp cement mill, 4.2 × 14m, rated for 80 mtph at 2900 Blaine.
- Cemento Noroeste, La Rioja province: Projected new plant with a capacity of 350,000 mtpy.
- Corp. Cementera Argentina S.A., Capdeville plant: Expansion incorporating F.L. Smidth 2,000 tpd kiln with a four-stage cyclone preheater and a Folax grate cooler. Scheduled operation: 1981.
- Corp. Cementera Argentina S.A., Yocsina plant: Adding F.L. Smidth four-stage cyclone preheater.
- Calera Avellaneda S.A., Olavarria: Converted second production line to the KHD Humboldt Wedag Pyroclon process for raw meal precalcining. Modification raises clinker production rate of that line from 1,000 mtpd to 1,500 mtpd. Scheduled onstream in 1981.
- Cementera Santa Cruz: New 636,000 tpy plant will be built by Spanish firm, Ateinsa, in Santa Cruz province. Site is on the Deseado River near Pico Truncado. Calcite from Cementera's nearby quarry will be used. Scheduled onstream in 1983.
- Petroguimica Comodoro Rivadaria S.A.: Adding 120,000 mtpy. Technical assistance by Asland S.A.
- Cementos Noa, Juramento, province by Salta: Constructing S.A. has technical responsibility for the project and plant. Buhler-

Miag and Ateinsa providing major equipment including limestone crusher; clay crusher; Miag 3,800 kW raw mill; 4.6×70m kiln with four-stage preheater; 3,800 kW cement mill; bagging plant. Scheduled onstream: 1984

Bolivia

- Fabrica Nacional de Cemento S.A.: Cal Orcke plant expansion via one Polysius Dopol preheater kiln rated at 880 mtpd. Onstream in 1981.
- Lafarge Consultoria e Estudios, subsidiary of Lafarge Conseils et Etudes (Lafarge Group) for Latin America, has been awarded a consulting engineering contract in Bolivia for the construction of the new Yacuces cement plant in the province of Chiquitos, department of Santa Cruz. The contract was awarded by the Corporacion Regional de Desarrollo (Regional Development Agency) of Santa Cruz. The new dry process plant will have an annual clinker production capacity of 335,000 tons, and the kiln will be equipped with a cyclone preheater. Start up is scheduled for 1983.
- Corporaciones de Desarrolo. Lafarge Consultants Ltd. of Montreal, Canada, in consortium with the Bolivian firm C.B.P.I., has been awarded a contract to provide the design for a new 150,000 mtpy cement plant to be located at Sevaruyo about 100 miles south of the town of Oruro in Bolivia. The contract covers a geological study of the limestone deposits in Cerro Pahua, design of the infrastructure works, plant technical design, detail civil engineering, and preparation of specifications for major equipment.

Brazil

- Cimento Maua, S.A. (Companhia Nacional de Cimento Portland), Cantagalo, state of Rio de Janeiro: New plant has been designed for a 700,000 mtpy production. Equipment, to be supplied by a consortium of F.L. Smidth and Christiani-Nielsen, will include a 3.95×56m precalciner kiln with Folax grate cooler; a 5.2×9.75m raw mill; and a 3.8×12m cement mill. CNCP and Lafarge Consultoria e Estudio (Brazil) are the consulting engineers on the project. Onstream: 1982.
- Camargo Correa Industrial S.A.: Expanding Apiai, Sao Paulo plant with a 3,500 tpd precalciner-preheater kiln addition. Expansion also will include crushing, grinding, material handling, and shipping equipment. Engineering design to be provided by Bendy Engineering Co.
- Cimento Itau do Parana S.A.: Rio Branco do Sul, Parana plant, doubled capacity with 1,000 tpd production line. F.L. Smidth supplied equipment including 4.15×60m kiln with four-stage preheater and Unax planetary cooler; 4×7m raw mill; 4×12m cement mill. Onstream in 1981.
- Cia de Cimento Portland Poty., Sao Jose Paulista: Pernambuco plant expansion via one 2,000 tpd dry process kiln. Scheduled operation in 1981.
- Cimento Tocantins S.A.: Sobradinho plant expansion planned via a 1,000 tpd dry process kiln.
- Cimenvale-Mineracao e Cimento Vale do Itajai S.A.: New plant at Brusque, Santa Catarina, under construction.
- Cia Cearense de Cimento Portland: Sobral, Ceara plant expansion with one F.L. Smidth 1,000 tpd dry process kiln. Onstream in 1981.
- Cia de Cimento Portland Goias, Palmeiras De Goias: Onstream in 1980. One Polysius precalciner kiln rated at 880 tpd.
- Cimento Santa Rita, Itapevi cement works: Increasing capacity of No. 4 kiln line from present 800 mtpd to 1,350 mtpd by addition of KHD Humboldt Wedag Pyroclon system for precalcination of raw meal. Equipment and installation to be provided by a consortium of KHD Humboldt Wedag and Zanini of Brazil.
- Cimento Tupi S.A., Pedra do Sino and Volta Redonda Cement Works: A consortium, Zanini Equipamentoes Pesados S.A./Humboldt Wedag Div. of Otto Deutz S.A. Motores e Tratores, is supplying equipment for expansion of both plants. At Pedra do Sino (about 400 km west of Rio de Janeiro), the production of a cement clinker line is being increased from a previous 1,800 metric tons to 2,550 mtpd via the Humboldt Wedag Pyroclon process. Consulting engineers: Cementia Engineering & Consulting, Ltd. (Switzerland). Reconstruction completed in 1982.
- Cimento Portland Asland do Parana: Planning construction of 1.5 million tpy plant in the state of Parana. Technical assistance from Asland do Brazil.
- Cia Cimento Portland Itau. Itau de Minas (Minas Gerais) plant extension: F.L. Smidth supplying 4×7m raw mill; 4.55×68m Unax kiln; two 4.4×13m cement mills scheduled onstream in 1983.
- Cia de Cimento Portland Rio Branco, Curitiba (Parana) plant: Adding two new production lines, each rated at 2,200 tpd. F.L. Smidth will supply major equipment, including: 5×8.5m raw mill; 5×80m Unax kiln; two 4×12m cement mills. Scheduled onstream in 1982.
- S.A. Industrias Votorantim, Salto de Pirapora, state of Sao Paulo: New 2,500 mtpd plant, due onstream in 1982. F.L. Smidth supplying major equipment including 5×10.75m raw mill; 5×80m Unax kiln; two 4.2×13m cement mills.
- Pragoinvest (Czechoslovakia) has received contracts for three 1,000 mtpd cement plants. The plants are to be located at Itapissuma, Itaguarana, and Itaguassu. At each plant, equipment will comprise a 4.4×12m raw mill, 4.2×13m cement mill, 72m long kiln with preheater. Scheduled onstream gradually in 1983-1984.
- Pragoinvest plant rated at 1,400 mtpd is under construction at Manaus.
- CIMINAS-Cimento Nacional de Minas S.A., Pedro Leopoldo plant: Adding a new 2,900 mtpd production line. Major equipment supplied by F.L. Smidth, includes 5.6×7.25m plus 2.8m Tirax raw mill; 5.25×83m, 2,900 mtpd kiln with riser duct calciner and Unax cooler; two 4.2×13m Unidan finish mills; 108m circular homogenizing store for limestone. Scheduled for 1984 operation.

Chile

- Fabrica de Cemento El Melon S.A., Santiago: Two phase expansion program will increase annual output at the El Melon works from 750,000 tpy to 1.25 million tpy by 1983. The first phase of the expansion plan will be the installation of a new 5.750 horsepower cement mill, to be built by the Danish company F.L. Smidth. The mill will increase the grinding capacity at the works to 750,000 tpy. The second phase involves the construction of a new kiln, incorporating a precalciner and a four-stage preheater, to supplement the four coal fired dry process kilns already in use at the works.

- Cemento Cerro Blanco de Polpaico, S.A., Polpaico (45 km north of Santiago): Polysius S.A., Madrid, Spain, a subsidiary of Krupp Polysius A.G., West Germany, has signed a contract to expand the existing cement plant 500,000 metric tons of clinker/year to bring total plant output to 1.3 million mtpy. The main items in the expansion are wet grinding with two wet process mills serving as primary and secondary mills, for a total of 130 tph with flotation to reduce the silica in the raw material, a dryer, a rotary kiln system with a Dopol preheater, and grate cooler for a kiln capacity of 1,500 mtpd, and a finish mill with an output of 90 mtph. Start-up scheduled for 1983. Holderbank Consulting Ltd. will carry out the engineering and complete project management.

Colombia

- Cementos Rio Clara (ARGOS Group): New plant, rated at 1,500 tpd clinker, will be located on the new main road between Medellin and Bogota. Scheduled for 1985 commissioning. Holderbank to assist in planning.
- Acerias Paz del Rio: setting up a 600,000 tpy slag cement plant at Belencito, province of Boyaca. Major equipment suppliers are Kawasaki Heavy Industries Ltd. and Marubeni Corp. Completion was scheduled for 1981.
- Fabrica de Cemento Samper, S.A. has awarded a contract to F.L. Smidth for the extension of its La Calera plant, 30 km from Bogota. The 1,500 tpd production line includes a 5×165m rotary kiln with two-stage cyclone preheater and Unax planetary cooler. Onstream in 1982.
- Cementos del Caribe, S.A., Barranquilla: Expanding wet process plant with Allis-Chalmers 14 ft.×12.5 ft.×450 ft., 800 mtpd kiln and Allis-Chalmers 900 mtpd stoker-type cooler. Was scheduled for 1981 operation.
- Cementos Diamante S.A., Cucuta: Expansion underway from 75,000 mtpy to 150,000 mtpy by transforming existing long-dry kiln into a suspension preheater operation. Completion scheduled for 1982. Prospective Engineering Gestion is the consulting engineering firm.

Ecuador

- Empresa Cementos Selva Alegre S.A.: Building a 345,000 mtpy plant at Otavalo which was scheduled for start-up in 1981. Allis-Chalmers Canada Ltd. furnished major equipment including 206 ft.-high preheater, 14½ ft.×204 ft. rotary kiln, stoker cooler, raw and finish grinding mills. SNC Inc. of Montreal served as the engineer/manager.
- La Cemento Nacional, Guayaquil: Expanding Cerro Blanco plant. F.L. Smidth supplying the following major equipment for a 1,500 mtpd addition: 4.35×66m kiln equipped with a single-string, four-stage preheater; Folax grate cooler; 4.6×8.25m Tirax Unidan raw mill; Allis-Chalmers 13 ft.×45 ft. Compeb clinker grinding mill, 4,200 hp; continuous silo blending system; dust collectors. Onstream in mid-1981. Holderbank Consulting Ltd. was the engineering consultant firm.
- Empresa Industrias Guapan S.A., Azogues: New plant scheduled for 1981 start up. Equipment, to be supplied by Fuller Co., includes one 13½ ft.×190 ft. rotary kiln; 1,100 mtpd suspension preheater; 13 ft. diameter×26 ft. Aerofall raw mill; 12 ft. diameter×37 ft., two-compartment finish mill; air-quenching grate cooler; blending silo aeration system; Airslide fluidizing gravity conveying systems; Fuller-Kinyon pumps; Plenum-Pulse dust collectors; central control console. Sereland (Spain) is providing consulting engineering and technical assistance.
- The board of directors of Empresa Cement Chimborazo C.A. has approved plans to expand their existing cement plant near Rio Bamba. The expansion will be 500,000 tpy, precalciner line complete with new raw, finish grinding, and quarry departments. The new expansion project definition and design study will be carried out by Lafarge Consultants Ltd., Montreal, Can.

Empresa Cemento Chimborazo presently is adding a precalciner to an existing kiln and doubling their stone crushing facility.

Paraguay

- Industria Nacional del Cemento, Itapucumi: New 600,000 mtpy dry process plant to increase total production to 800,000 mtpy. Consulting engineers: Asland SA (Spain). Scheduled onstream in 1983.
- A cement plant is to be built 300 miles north of Asuncion. A French group led by Bureau Central pour les Equipments Outre-Mer has contract to build the 600,000 tpy facility. Scheduled completion date: 1984.

Peru

- Cemento Yura S.A., Arequipa: Adding 1,000 tpd dry process kiln. Fuller Co. supplied the following equipment: one 12 ft.×37 ft. raw mill; one blending system; one 12 ft.×37 ft. finish mill; five Plenum-Pulse dust collectors. Onstream in 1981.
- Industria Nacional de Cemento, Vallemi plant: GATX-Fuller S.A., Spain has $6 million contract to convert two wet kiln lines to dry process. Kilns will be cut and modified and a four-stage suspension preheater installed on each. Capacity of each kiln will be increased by 300 mtpd to give an estimated total of 1,400 mtpd. Engineering consultant: Stejas, Spain. Scheduled onstream in 1983.

Venezuela

- Cementos Cordillera, Sanares: New 300,000 tpy plant. Onstream in 1981.
- Cemenorca, Punta Cotua, Sucre: Asland completed feasibility study for 1 million tpy plant. Scheduled onstream in 1985.
- Consolidada de Cementos C.A.: Expansion at San Sebastian, Est. Aragua plant via one 2,400 tpd Allis-Chalmers dry process kiln. Scheduled onstream in 1982.

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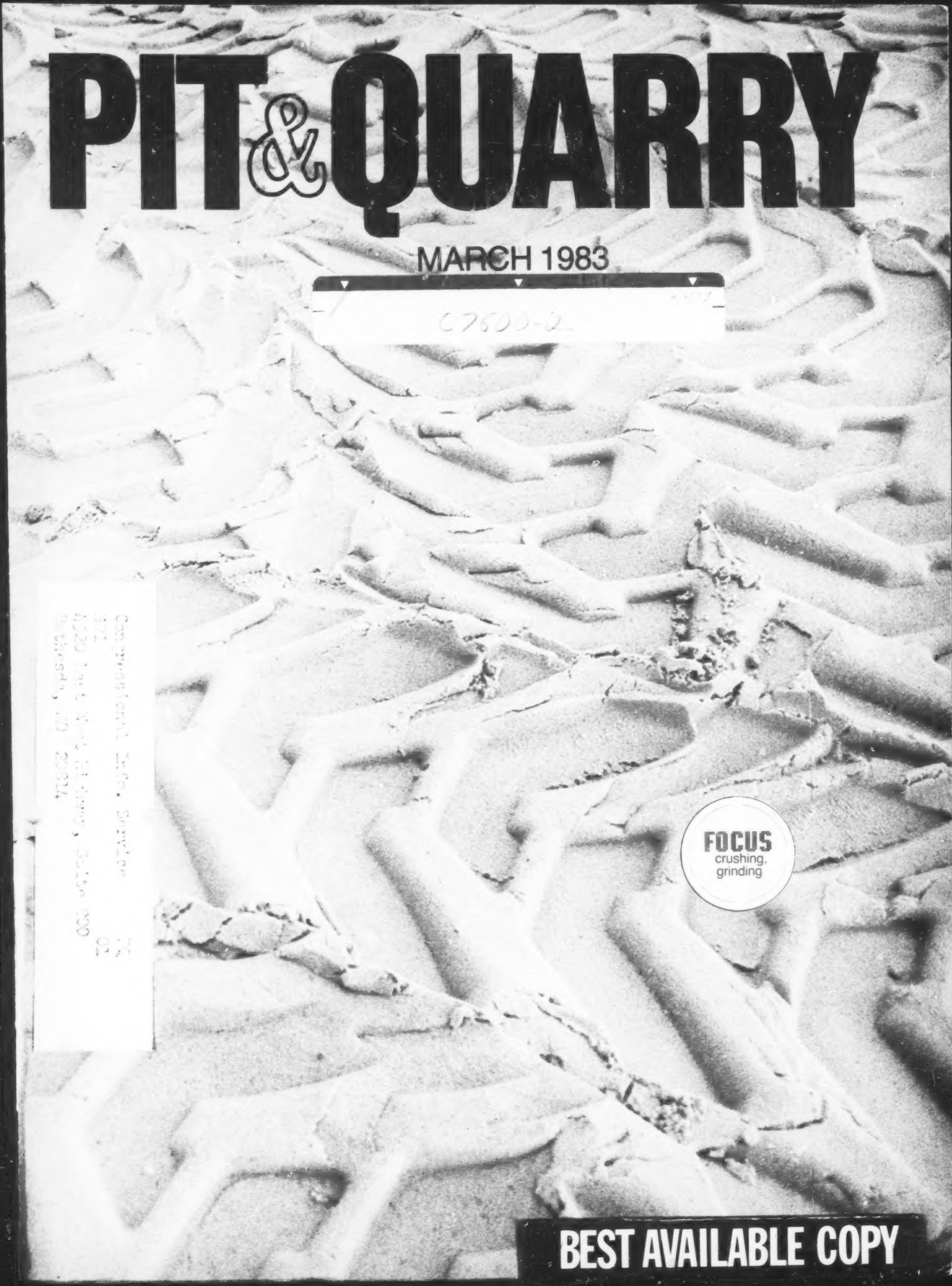

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AND NEXT MONTH

A focus feature deals with blasting claims, and an impressive pre-operation beautification project is presented.

ON THIS MONTH'S COVER

The sands bear evidence of a busy operation. Photo courtesy of Best Sand Co. See page 76.

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MEMBER

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Comparison of 1982/1981 Construction Contract Values*

	1982 12 Mos.	1981 12 Mos.	Cumulative % Change
Nonresidential building	$ 59,207.5	$ 60,087.7	−1
Residential building	58,076.3	60,164.0	−3
Nonbuilding construction	37,335.6	33,227.9	+12
Total construction	$154,619.4	$153,479.6	+1

Dodge Index
(1977 = 100, seasonally adjusted)
October 1982 105
November 1982 122
December 1982 131

**Based on statistics compiled by F.W. Dodge Div., McGraw-Hill Information Systems Co.*

Umm al Qiwain orders cement plant study

A feasibility study for a 1-million mtpy cement plant in Umm al Qiwain, United Arab Emirates, has been undertaken by Henry Pooley Atkins, part of the WS Atkins Group, on behalf of Umm al Qiwain Cement Industries Co.

The work is being carried out in several stages, the first is the selection of a suitable site and topographic and hydrographic surveys. Raw mix designs, using raw material chemical analyses, are being carried out to determine types of cement that can be manufactured and the most appropriate process to adopt.

A detailed feasibility study will incorporate further geological investigations and will assess the commercial and technical viability of the project.

Weightech conference set for October 4-6

The fourth Weightech exhibition and conference will be held at A.J. Cervantes Exhibition and Conference Center, St. Louis, Mo., October 4-6, 1983. The conference covers the technologies involved in industrial and commercial weighing, process control, and in force measurement.

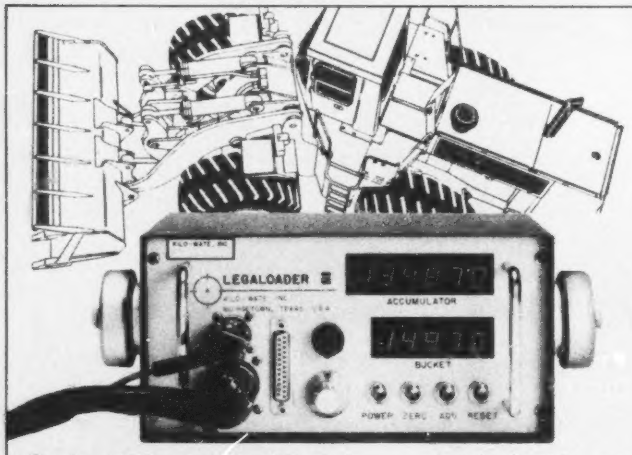
The 3-day conference will comprise a series of related subject sessions, and an international list of speakers will present papers on weighing, process control, and force measurement technology in a range of industrial and commercial applications.

A call for papers had been issued and information can be obtained by contacting Harry C. Lepinske, executive vice president, Oakbrook Exposition Management, 1000 Jorie Blvd., Oakbrook, Ill. 60521.

WACA names Blake president

David Blake, president of Blake Sand & Gravel, Inc., Sequim, was elected president of Washington Aggregates and Concrete Association for the 1982-83 term. Other new officers include C. James Emergy, Yakima Cement Products Co., Yakima, as vice president; and Norman Anderson, Lakeside Sand & Gravel Co., Issaquah, secretary-treasurer.

Elected as new directors are Dean Scott, Graytone Corp., Kent;



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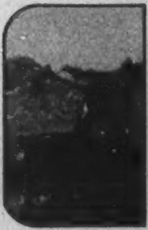
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AND NEXT MONTH

Recent developments in the lime industry.

ON THIS MONTH'S COVER

Blasting preparations at Vulcan Materials' Okolona Quarry highlight this month's focus subject.

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of aggregate processing equipment for the reduction, sizing and handling of metallic and nonmetallic materials. This equipment includes crushers, feeders, screens, conveyors, and portable and stationary plants. The firm also manufactures a line of shredders and related equipment used in the scrap and refuse markets, which is marketed through Hammermills, Inc.

Canadian Mining Equipment Exhibition May 10-12

Southex Exhibitions and Laurentian University jointly announced the Canadian Mining Exhibition will be held on the Laurentian University campus, Sudbury, May 10-12, 1983.

In conjunction with the exhibition, Laurentian University has scheduled a National Mining Seminar. Dr. T. S. Golosinski, professor of Mining Engineering at the University of Alberta's Department of Mineral Engineering will lead the 2-day seminar which will include a series of workshops on open pit mining.

Comparison of 1983/1982 Construction Contract Values*

	January 1983 1 Month	January 1982 1 Month	Cumulative % Change
Nonresidential building	$ 4,458.8	$ 3,866.2	+15
Residential building	4,970.1	2,990.6	+66
Nonbuilding construction	1,947.4	4,471.6	−56
Total construction	$11,376.3	$11,328.4	0

Dodge Index
(1977 = 100, seasonally adjusted)
November 1982 122   December 1982 131   January 1983 127

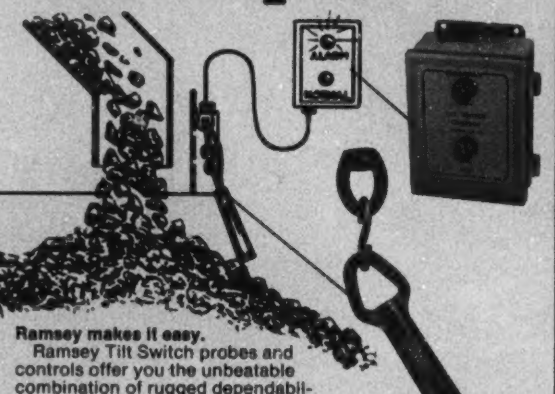
**Based on statistics compiled by F.W. Dodge Div., McGraw-Hill Information Systems Co.*

For more information regarding the exhibition contact the Canadian Mining Exhibition, Don Mills Rd., Don Mills, Ont. M3B 2X7; for information regarding the seminar contact Don Stone, Communications & Development Department, Laurentian University, Ramsay Lake Rd., Sudbury, Ont. P3E 2C6.

Participants sought for subcommittee on lime

Additional participants are sought for a new subcommittee addressing lime and limestone used in emissions control and water control. Subcommittee CO7.04 on Lime and Limestone for Environmental Uses was formed under the auspices of ASTM Committee C-7 on Lime.

The main scope of the subcommittee is to develop standards for lime and limestone used in environmental control systems and to determine the needs for appropriate test methods for such specifications. In addition, the scope of the intended work covers the advanc-



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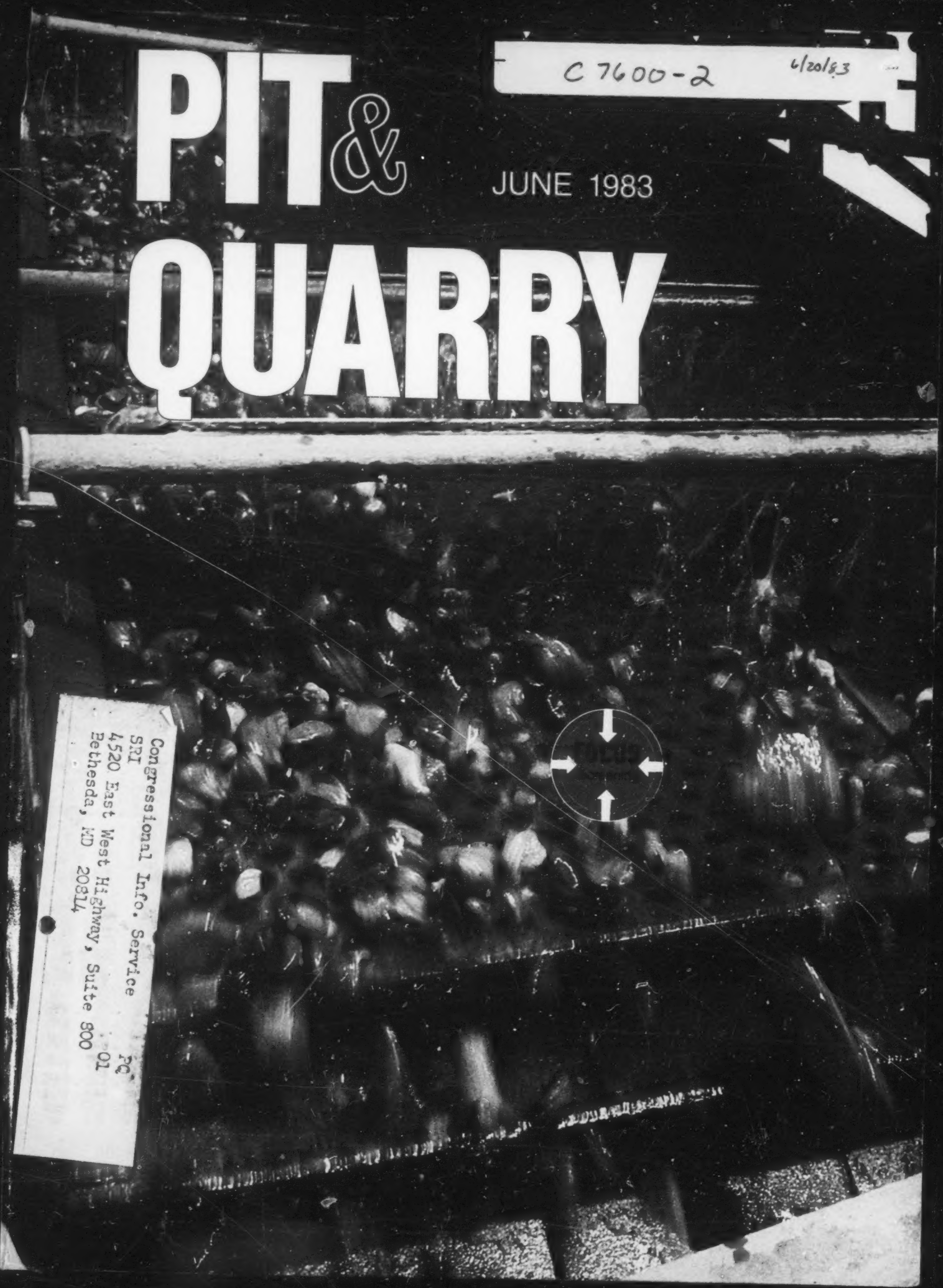
JUNE 1983



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ON THIS MONTH'S COVER

Operating and economic pros and cons of screening media are discussed in this month's focus feature. Photo courtesy Hewitt-Robins.

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MEMBER

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New intermediate grade cement introduced

SECAR 60, an intermediate grade, 60% Al_2O_3 cement with enhanced refractory characteristics, has been introduced by Lone Star Lafarge, Inc., Norfolk, Va. The firm said the product's low iron content makes it particularly useful in carbon monoxide-containing atmospheres. When mixed with appropriate aggregates, this new cement gives abrasion resistant castables for a wide range of applications including petrochemical refractories and blast furnaces, the firm said. For more information, write: 18 Koger Executive Center, Suite 220, Norfolk, Va. 23502.

NLI publishes acid rain pamphlet

The National Limestone Institute has published "Understanding Acid Rain," an overview of the acid rain issue which discusses the potential role the limestone industry will play in reducing the problem's harmful effects. Copies can be obtained for a nominal charge by contacting the NLI, 3251 Old Lee Highway. Suite 500, Fairfax, Va. 22030.

New York plant wins ESCSI safety plaque

The Northeast Solite Corp.'s Saugerties Plant, Mt. Marion, N.Y., has been awarded the top safety prize for most accident-free man-hours in 1982, the Expanded Shale Clay and Slate Institute announced. Certificates of achievement also were awarded to the following companies for having no lost-time accidents last year: Arkansas Lightweight Aggregate Corp., West Memphis, Ark.; Carolina Solite Corp., Aquadale Plant, Albemarle, N.C.; Florida Solite Co., Green Cove Springs, Fla.; Kentucky Solite Corp., Hubers Plant, Brooks, Ky.; Virginia Solite Co., Leaksville Plant, Cascade, Va.; Solite Corporation, A.F. Old Plant, Arvonia, Va.; and Utelite Corporation, Coalville, Utah.

Comparison of 1983/1982 Construction Contract Values*

	1983 2 Mos.	1982 2 Mos.	Cumulative % Change
Nonresidential building	$ 8,656.5	$ 9,665.7	−10
Residential building	9,742.4	6,036.8	+61
Nonbuilding construction	4,266.5	6,715.1	−36
Total construction	$22,665.4	$22,417.6	+1

Dodge Index
(1977 = 100, seasonally adjusted)

December 1982 ..... 131 January 1983 .... 127 February 1983 119

**Based on statistics compiled by F.W. Dodge Div., McGraw-Hill Information Systems Co.*

NSGA co-sponsors sand and gravel operator's forum

The National Sand and Gravel Association and the Aggregate and Ready-Mix Association of Minnesota are co-sponsoring an operator's forum on practical operating topics, such as plant design, screening, loader maintenance, conveyors, and more. The 3-day event includes plant tours and is being held at the Thunderbird Hotel in Minneapolis-St. Paul, Minn., July 17-19, 1983. For additional information contact: NSGA, Engineering Division, 900 Spring St., Silver Spring, Md. 20910.

Texas Industries orders 42 covered hopper railcars

Texas Industries, Inc., Dallas, Tex., has ordered 42 3,200-cu. ft. covered hopper cement cars from Portec, Inc.'s Railcar Division. The cement cars, which have special design features, will be used to transport cement in captive service between Texas Industries' plant in Hunter, Tex., and a new distribution center in Katy, Tex. The cars will operate on the Missouri-Kansas-Texas (KATY) Railroad.

PCA Northwest Region bridge design award program

The Rocky Mountain-Northwest Region of the Portland Cement Association has announced its annual program to recognize excellence in structural and architectural design of bridges built in the states of Alaska, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, and Wyoming. The program includes all types of bridges—highway, railway, and pedestrian—in which concrete is the basic structural system.

Any organization, public or private, may submit entries. Awards will be given in recognition of creativity and imagination in the structural, functional, aesthetic, and economical design of concrete bridges. Entries must be submitted before June 30, 1983. Contact the Portland Cement Association, 925 S. Niagara St., #200, Denver, Co. 80224.

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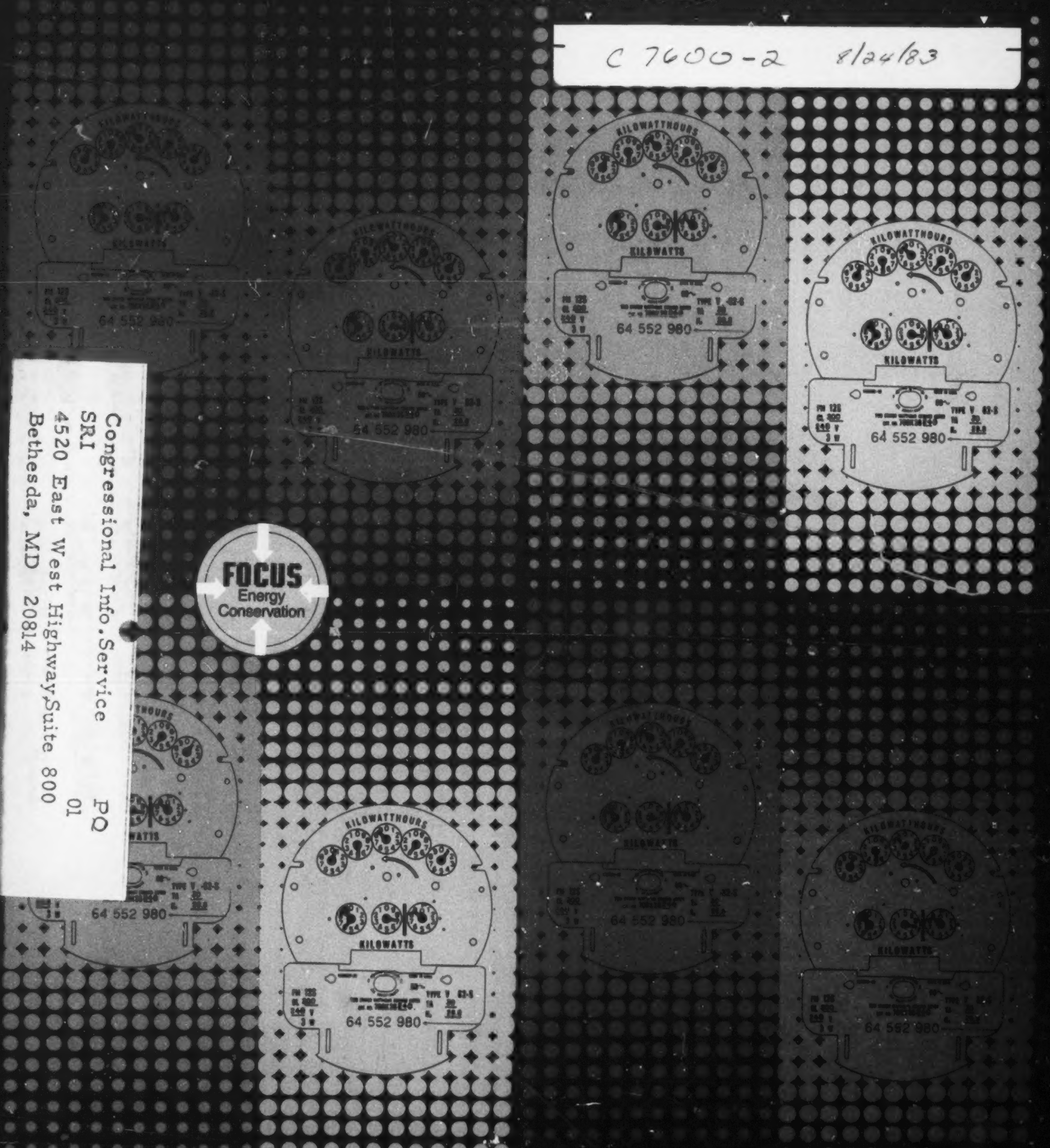
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ON THIS MONTH'S COVER

Staff art schematic depicting typical kilowatt/hour meters as shown in Duke Power Company's *Land Management*.

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MEMBER

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Comparison of 1983/1982 Construction Contract Values*

	5 Mos. 1983 (000,000)	5 Mos. 1982 (000,000)	Cumulative Percent Change
Nonresidential building	$23,578.8	$24,809.7	− 5
Residential building	33,683.4	20,352.9	+65
Nonbuilding construction	16,690.9	15,959.0	+ 5
Total construction	$73,953.1	$61,121.6	+21

Dodge Index
(1977 = 100, Seasonally Adjusted)

March 1983	April 1983	May 1983
131	129	148

**Based on statistics compiled by F.W. Dodge Div., McGraw-Hill Information Systems*

NCSA About Face Program marches forward

The National Crushed Stone Association is asking members to submit entries to its About Face Program that is designed to encourage the industry to improve its public image through plant beautification. Members may enter by sending photos and a short description of improvements to the NCSA. Three classifications of awards allow for the smaller improvements to be recognized as well as the complete beautification project.

Photos should be "before" and "after" changes, but if that is not possible, photos should try to encompass as much area as possible, including those areas where plans for improvements are in the works. The written plans, including how the work was done and what will be done to maintain it, also should be sent. The ultimate aim of the project is to have plants blend with the environment, be compatible with a community's attitudes, and make known to the public the plant's efforts to do both. For more information on the program, contact Paula Burns at NCSA.

Dravo Corporation forms new subsidiary

Dravo Corporation, [illegible], Pa., has announced the incorporation into a separate subsidiary of its Dravo Natural Resources Co., which was established in 1982 to consolidate all the parent firm's aggregate, lime, and coal operations.

Dudley E. Dawson, Jr., a corporate senior vice president, has been named chairman and chief executive officer of the new company, headquartered in Mobile, Ala. Ezra B. Trice will be president and chief operating officer.

The new organization replaces Dravo's former Natural Resources Group and Southern Industries Corp., which merged with Dravo in 1979. The Southern Industries name will no longer be used. The new company will conduct business through three operating units: Dravo Lime Co., Dravo Basic Materials Co., and Dravo Coal Co.

NLA announces technical conference

The National Lime Association has announced that it will hold a 2-day technical conference September 27-28, in Denver, Colo., on the subject of effective use of lime for flue gas desulfurization. The featured speaker is Sen. Robert T. Stafford, chairman of the Senate Environment and Public Works Committee, who will discuss the acid rain issue.

Up-to-date information on the design and performance of lime-based FGD systems will be presented at the sessions. For information contact NLA, 3601 N. Fairfax Dr., Arlington, Va. 22201.

Papers presented at land reclamation meeting in book

Proceedings: Shaping Land for Tomorrow is a compilation of papers presented at a land reclamation conference sponsored by the Michigan State University's School of Urban Planning and Landscape Architecture. Papers presented by landscape architects, geologists, ecologists, planners, mining companies, and government officials focus on construction aggregate mining. Subjects include earth sculpturing, creating wildlife habitats, preparing for mining permits, restoration of agricultural lands, and visual im-

Coming Events

• • • • • • • • • • • • •

NATIONAL ASSOCIATIONS

SEPTEMBER 27-28
National Lime Association Technical Conference
Stouffer's Denver Inn
Denver, Colo.
Contact: NLA
3601 N. Fairfax Dr.
Arlington, Va. 22201

OCTOBER 2-5
Expanded Shale Clay and Slate Institute
31st Annual Meeting
Broadmoor Hotel
Colorado Springs, Colo.
Contact: ESCSI
4905 Del Ray Ave., Suite 210
Bethesda, Md. 20814

OCTOBER 11-13
National Lime Association Operating Meeting
Westin Hotel
Cincinnati, Ohio
Contact: NLA
3601 N. Fairfax Dr.
Arlington, Va. 22201

OCTOBER 17-20
71st Annual National Safety Congress
Conrad Hilton Hotel
Chicago, Ill.
Contact: Congress Planning
444 N. Michigan Ave.
Chicago, Ill. 60611

OCTOBER 19-21
Society of Mining Engineers of AIME
Fall Meeting and Exhibit
Salt Palace
Salt Lake City, Utah
Contact: Meetings Department
Society of Mining Engineers of AIME
Caller No. D
Littleton, Colo. 80127

STATE ASSOCIATIONS

AUGUST 12-14
Georgia Crushed Stone Association
Midyear Meeting
Callaway Gardens
Pine Mountain, Georgia
Contact: G.C.S.A.
(404) 451-3573

NOVEMBER 17-18
Pennsylvania Aggregates and Concrete Association
2nd Annual Meeting
Hotel Hershey
Hershey, Pa.
Contact: PACA
3509 N. Front St.
Harrisburg, Pa. 17110

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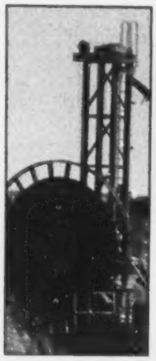

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Acid rain problem may meet nemesis in form of limestone and lime materials (See p. 50) staff art by Janet Wilcox.

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MEMBER

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Sat., Feb. 18
Equipment displays and local area field trips
Sun., Feb. 19
Departure on homeward flight for delegates not participating in post-conference tour

The post-conference tour will include visits to the Clyde Dam construction project and its on-site aggregate processing plant; the Palmers Quarry, described as the largest operation in the region; a major, multi-faceted construction operation; and a former quarrying area that has been developed into a wildlife park. The tour will terminate at Christchurch, with departure for the U.S. on Friday, March 2.

For additional information, contact William L. Carter, president of NCSA, 1415 Elliot Place, N.W., Washington, D.C.

N.Y. office relocates; Ruth Keran retires

The New York office of Pit & Quarry Publications, Inc., has relocated to 80 Greenwich Ave., Greenwich, Conn. 06830. Phone (203) 869-4066/4067. Ken Derbyshire continues as our eastern sales representative.

Mrs. Ruth V. Keran, office manager, has retired after more than 10 years of service with the company. Best wishes, Ruth!

PCA Educational Services offering course variety

The Portland Cement Association's Educational Services Department is offering courses concerning the concrete industry ranging from testing to sales; all classes will be held at PCA's headquarters in Skokie, Ill.

"Controlling Concrete Quality in Production and Construction," to be held Oct. 24-27, is designed for anyone needing to be certified as a concrete field testing technician-Grade I. Both classroom and laboratory work are included. Participants will have the opportunity to take the American Concrete Institute certification test at the completion of the course. Class number is limited to 24; the cost is $600.

"Sales Training I," offered Oct. 31-Nov. 3, is co-sponsored by the National Ready Mixed Concrete Association, the National Sand

Comparison of 1983/1982 Construction Contract Values*

	6 Mos. 1983 (000,000)	6 Mos. 1982 (000,000)	Cumulative Percent Change
Nonresidential building	$29,578.7	$31,008.1	− 4
Residential building	44,089.3	26,315.3	+68
Nonbuilding construction	20,476.3	18,864.1	+ 9
Total construction	$94,324.3	$76,187.5	+24

Dodge Index
(1977 = 100, Seasonally Adjusted)

April 1983	May 1983	June 1983
129	148	151

**Based on statistics compiled by F.W. Dodge Div., McGraw-Hill Information Systems*

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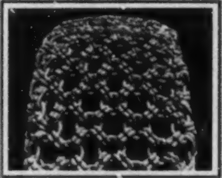

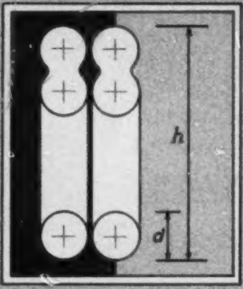

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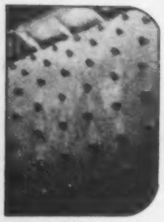

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AND NEXT MONTH

Automatic control systems for processing and product handling will be featured in several articles

ON THIS MONTH'S COVER

A kaleidoscope of tools (look closely—each is depicted in an aggregate design) symbolizes the constantly changing pattern of the job that never ends. Art by Janet Wilcox.

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MEMBER

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federal-aid highway funds. Including both the funds controlled by the fiscal year 1983 limitation of $12.375 billion and exempt funds, such as emergency relief, the total for the fiscal year is expected to reach $12.8 billion. That would be a 56% increase over the $8.2 billion reached in fiscal year 1982.

Comparison of 1983/1982 Construction Contract Values*

	7 Mos. 1983 (000,000)	7 Mos. 1982 (000,000)	Cumulative Percent Change
Nonresidential building	$ 34,902.2	$36,191.5	− 4
Residential building	52,934.1	31,512.2	+68
Nonbuilding construction	23,571.5	21,506.9	+10
Total construction	$111,407.8	$89,210.6	+25

Dodge Index
(1977 = 100, Seasonally Adjusted)

May 1983 .... 148 June 1983 .... 151 July 1983 137

**Based on statistics compiled by F.W. Dodge Div., McGraw-Hill Information Systems Co.*

Phosphate producers vs. legislators

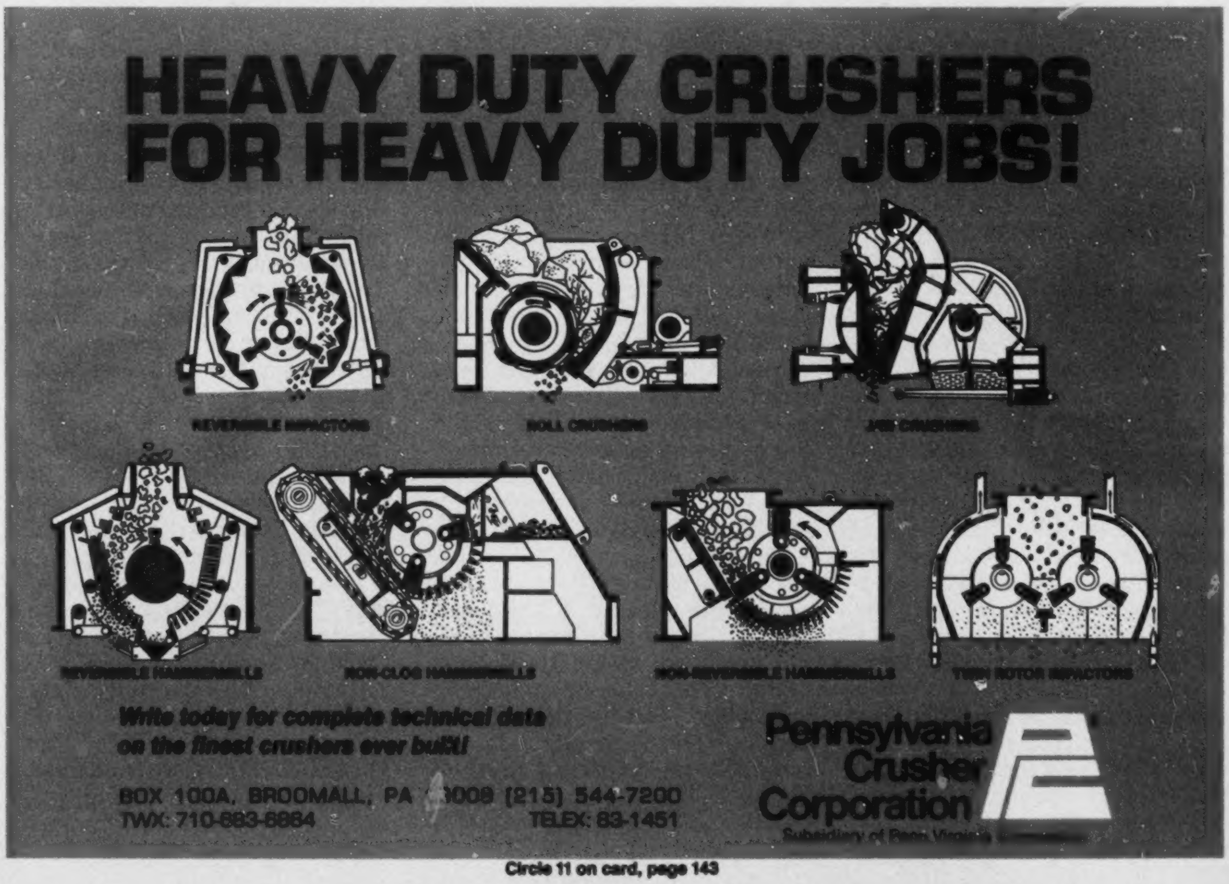
The Florida Phosphate Council is against proposed legislation that would require the Florida phosphate industry to ship at least 5% of all exports and imports on U.S. flagships in 1984, with the rate gradually increasing to 20% in 15 years. In opposition the council says that because phosphate is a generic product, price is the critical issue in a sale, and that freight rates on U.S. ships average 100% to 300% higher than on foreign ships. Being forced to use more U.S. ships would give foreign producers an unfair advantage, the council says.

Although lawmakers may see this "protectionist" legislation as creating or saving jobs, the council contends that such moves would force U.S. producers to decrease exported tonnage, reduce production, and subsequently, compel the loss of 6,000 to 8,000 jobs.

Kaiser Cement withdraws suit against McDonough

Kaiser Cement Corp. and Hanson Trust PLC have announced that Kaiser has agreed to withdraw its claims against Hanson Trust and its subsidiaries from the suit that recently was filed by Kaiser in San Antonio, Tex. The two entities, while reserving their rights against one another, said that this immediate action was being taken to create an atmosphere conducive to settlement negotiations.

The suit as amended by Kaiser relates to a dispute concerning an interpretation of certain provisions of a long term contract to supply cement clinker to McDonough Company of Parkersburg, W.Va., an indirect Hanson Trust subsidiary. In 1981, Marmac Corporation of Parkersburg purchased McDonough's cement operation for $49 million and agreed to purchase the clinker that McDonough was under contract to buy. Settlement discussions among Kaiser, McDonough, and Marmac are underway.



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Bureau of Mines study reveals increasing hazards

Report offers practical guidelines to reduce accidents

By Dennis A. Long

The Bureau of Mines recently conducted a study of safety problems related to the maintenance of haulage trucks. Analysis has quantified the safety hazard in terms of job activities, truck components and systems, tools involved, and truck design. This article explains the study findings and presents recommendations for change; the latter, it is hoped, will help ameliorate the increasing hazards to mechanics responsible for truck maintenance.

Personnel

Workers below the age of 31 were involved in 49% of all truck maintenance accidents. Workers with less than 6 months' experience in the particular job held at the time of the accident accounted for 27% of all accidents; 59% had less than 3 years of job experience. Maintenance personnel, including mechanics, helpers, and trainees, accounted for 65% of the accidents while the mine equipment operators accounted for more than 25%.

To examine the nature of the injuries, the Bureau classified the severity of haulage truck maintenance accidents by work days lost (Table 1). Most maintenance accidents were not characterized by severe injuries as 33.5% involved no lost time and 41.3% involved between 1 and 15 lost days. Information from mine visits indicates that maintenance also accounts for a large number of unreported accidents.

Major categories for body parts injured in maintenance accidents are: head and neck injuries, 16.2%; major body injuries involving the chest, back, hip, or trunk, 33.5%. Back injuries accounted for 16.1% of the accidents, eye injuries for 7%. Maintenance injuries commonly involve the extremities, accounting for more than one-half of all accidents. This includes hand (22.5%), leg (10.1%), and foot (7.3%).

Most of the time, injuries were the result of the lack of proper training for the particular job. Unsafe actions accounted for 71.5% of all accidents. This category includes taking an unsafe position, using equipment in an unsafe manner, nullifying safety devices, failure to use a platform or personal protection, and horseplay. About 41% of all accidents were caused by the worker taking an unsafe position, such as reaching beyond the lifting radius or attempting to climb a ladder with a heavy part in hand. Failure to secure caused 19%, and included causes such as improper support of heavy parts and components or failure to secure the truck box.

Because of the significant number of accidents due to unsafe actions, a key safety problem obviously is lack of effective skill training. Further examination of the problem reveals that mainte-

surround truck maintenance

nance personnel commonly were:

- Performing tasks for which they were not formally or adequately trained e.g. equipment operators doing maintenance-type work and maintenance mechanics tramming a piece of equipment to and from the shop. More than one-fourth of all haulage truck maintenance accidents involved equipment operators.
- Not following prescribed procedures or safety precautions. This would include disregarding lockout procedures or nullifying a safety device.
- Working with inadequate or improvised tools and equipment. Although the mechanic may be taking an unsafe action, there may not be another way to do the job.

Most maintenance training in the mines consists of safe work briefings followed by on-the-job experience under either a lead mechanic or a senior employee. Instruction varies and is based on the teaching skills of the supervisor. Experience is not necessarily the best teacher. Emphasis should be placed on recognizing specific hazards, knowledge of proper job procedures for the various truck models and systems, and correct use of tools and equipment.

Proper job procedures and tool use could be enhanced through easy-to-use troubleshooting guides. Fewer than half of equipment manufacturers provide such guides for their products. Most of the available guides need to be improved substantially in terms of both effectiveness and ease of use. Only four major manufacturers were praised frequently for providing good-to-excellent troubleshooting guides.

The second most frequently identified training need was for guidebooks for specific maintenance tasks such as a manual on the haulage of truck electrical system, cooling system, hydraulics, or electronic components. Again, several manufacturers have materials that can be purchased, but they cover only a limited number of maintenance tasks on a specific truck model. Some manufacturers have no effective manuals for their products. The following guidelines were identified by maintenance personnel for improvements in maintenance manuals:

- Must be specific, complete, and up to date. Numerous manufacturers try to use one manual for all makes and models. This makes manuals complex and lengthy. Older models are dropped and new ones added, but manuals are not updated.
- Must have a good cross-reference and index system.
- Should include an effective troubleshooting guide.
- Should provide updating capability so that technical corrections, improved maintenance procedures, and safety warnings can be brought to the attention of site personnel.
- Should be compact and easily portable for use in working sections.

Mechanics also should be trained and qualified to operate the equipment they maintain. Although their job involves shuttling equipment in the shop area, mechanics typically are not trained to operate the machines and are not familiar with their safe operating limits.

Shops and areas

As expected, most accidents occur in the shop where the maintenance usually takes place. Specifically, 70.7% of all haulage truck maintenance accidents occurred in the shop. The importance of accident location increases when it is considered that most maintenance activities take place within the shop facilities. Although 29% of the accidents studied occurred in the field, it is estimated that only about 10% to 15% of the maintenance work was done there. Thus, field maintenance work is two to three times more hazardous than shop work.

An important recommendation, to counter the hazards of field maintenance work, is to develop and use towing vehicles capable of moving disabled trucks to the shop. Towing a large haulage truck is difficult, involving two or more support vehicles and additional personnel. But, because of the high capital cost, only a few of the largest mining operations in the United States have specialized towing vehicles. Another solution might be to retrofit the truck so that it can be towed more easily.

Improved physical design of maintenance areas and equipment bays could help reduce accidents. Included here would be such factors as work space organization, housekeeping, illumination, ventilation, noise control, and transporting of parts. An effectively designed workspace could enhance productivity, allow more efficient use of tools, and improve safety. Roughly 30% of the accidents involved poor housekeeping practices.

Poor workspace organization

was common in most of the mines visited. It is manifested as follows:

- Handtools and small power tools strewn about or stored wherever space permitted, forcing people to climb over or reach around them.
- Tools or parts not conveniently located, requiring people to search for them.
- Shop floors covered with cables and hoses, presenting a tripping hazard.
- The work performed on oil or grease splattered ground or in the field on unimproved rocky ground.

Because most truck maintenance shops must service trucks larger than they were designed for, the space between truck bays often is insufficient to allow the use of tire grabbers for forklifts.

Table 1.—Truck maintenance accidents by lost work days, U.S. surface mines, 1978-1979, percent

0	33.5
1 to 5	19.6
5 to 15	21.7
15 to 30	8.9
30 to 60	10.1
over 60	6.2
Total	100.0

Table 2.—Truck maintenance accidents, by activity of the injured, U.S. surface mines, 1978-79, percent

Installing part	23.2
Removing part	18.2
Servicing equipment	16.2
Inspection	15.2
Getting on and off equipment	14.9
Movement around shop area	10.1
Cleaning	2.1
Total	100.0

Table 3.—Truck maintenance accidents, by source of injury, U.S. surface mines, 1978-79, percent

Truck body and/or large components	32.5
Work station	31.0
Tools and equipment	9.6
Shop area hazards	9.6
Truck parts	8.0
Tires, wheels, hubs, or rims	5.9
Heat or flame	3.4
Total	100.0

Table 4.—Truck maintenance accidents by tools and equipment, U.S. surface mines, 1978-79

Handtools	30.3
Elevated work platforms	15.3
Servicing equipment	15.3
Welding equipment	9.0
Push-pull equipment	9.0
Floor lifting equipment	7.5
Slings and chains	5.0
Support equipment	5.0
Power tools	1.2
Overhead lifting equipment	1.2
Cleaning equipment	1.2
Total	100.0

Another important truck-shop problem is communication. Large mining machines frequently have two or more persons working on or around them. It is important that these workers be able to communicate their intentions and actions to each other. Numerous accidents have involved communications breakdowns. Inexpensive technology is available to resolve many of these problems. Simple solutions could include lockout equipment or proper tagging of trucks being worked on.

Because of the high incidence of handtool-related injuries, it also is recommended that emphasis be placed on tool maintenance. Mobile racks should be developed for special tools; mechanics often improvise a tool setup when the proper tool cannot be found. Dealers or distributors should be encouraged to stock proper tools. Often the tools are manufactured, but are unavailable from the local distributor. Thus, the mine shop is forced to design and fabricate something on the spur of the moment.

Truck design for serviceability

Some problems are caused by poor design of the truck for routine or major maintenance. Design improvements would reduce substantially maintenance time and maintenance-related injuries.

The following are a few examples to illustrate the need for maintenance safety pre-planning for large off-highway haulage trucks. On one 120-ton capacity, electric-drive, rear-dump truck the changing of a wheel motor was particularly time consuming and hazardous. To remove the motor and expose the broken unit, it was necessary to remove the truck bed, the entire rear axle assembly, and the casing around the axle-wheel assembly. After the motor was removed and a new unit installed, the procedure was reversed for reassembly. Mine maintenance people suggest that this task easily could be performed, and with much improved safety, if access openings had been provided through the motor-axle housing.

Another example involved a 120-ton capacity, bottom-dump truck. To change fan belts or certain rubber hoses, either the radiator or the engine block had to be removed. Several minor injuries had been associated with this work. On certain larger trucks, personnel must crawl inside the rear axle housing to adjust the service brakes.

Other examples of poor design related to routine maintenance also were identified. For example, minor slip and fall accidents result when people mount large trucks to fuel them. This hazard increases in rain, snow, or icy weather. Likewise, inspections of engine fluid levels and critical hydraulic hoses, and similar checks, often are difficult and hazardous to perform. The machine surfaces crawled on or over typically are coated with grease.

By combining the truck maintenance accident data with field-gathered maintenance worktime, it was concluded that the most hazardous components to work on are tires and wheels, the truck body, suspension, and engine. The least hazardous components are brakes and drive train. Overall, a direct correlation exists between accidents and the size and scale of the component or part to be worked on. Through analysis of the accidents and mine surveys, a number of design problems relevant to truck maintenance were identified:

- Poor accessibility to machine parts or areas of the unit for routine or unscheduled maintenance tasks.
- Inadequate access openings to permit a person to reach or climb in for repairs or to replace parts.
- The need to remove or dismantle ancillary components in order to access the failed unit.
- Inadequate or non-existent provisions for the safe handling of heavy or large parts.
- Inadequate tools to perform the required maintenance task.
- The need to perform many repairs on the spot without the resources typically available in the shop area.

Because of the large size of many machines, these items interact to make field maintenance difficult and hazardous.

In some cases, specific equipment modifications, at the factory and at the mine, would help alleviate above-normal hazards. The changes could involve original equipment options to be offered by the truck manufacturers. New options that could enhance truck maintenance safety often are ignored, since the mine's safety department rarely affects truck purchasing decisions.

Improved truck design should be matched with redesign of components, procedures, tools, and manuals. The main design problems include the following:

- Designing machines that require unskilled-to-skilled mechanics to perform complex sequences of tasks in order to keep equipment operational.
- Requiring mechanics to manipulate large, heavy vehicle components in tight spaces with inadequate clearances, supports, and tools.
- Designing equipment so that accessibility for routine maintenance tasks is overly complex, such as having to remove a large radiator in order to change a fan belt.
- Providing inadequate access openings, clearances, and visibility for tasks to be performed.

A side-by-side comparison of older mobile mining equipment with newer models indicates that, although changes in truck design have occurred, the majority of changes have related either to the equipment operator's safety and comfort or to the production features of the truck. Much work remains to be done in the area of maintenance safety.

Job procedures

Further analysis of the data determined the frequencies for the various causes of the maintenance accidents. Table 2 lists accidents by activity of the injured. These generic activity descriptions were created to simplify the data analysis. Movement around the shop area and up and down the mobile equipment, accounted for about one-fourth of the injuries. This number reflects the need for adequate work platforms, access steps and ladders, and good housekeeping.

The job factors that contribute most to injuries include:

- Lack of knowledge about correct material handling practices.
- Limited aids for material handling such as lifting devices, jacks, and hoists.
- Lack of effective training programs and work procedures for manual material handling, typified by the prevailing attitude that back injuries due to lifting "will not happen to me."
- Inadequate workstands or platforms for support during tasks requiring reaching or lifting.
- Inadequate use of personal protection equipment such as gloves, lifelines, or other protective devices. More than 21% of the injuries to the hands or fingers would have been reduced or eliminated with gloves.
- Lack of supervision.

Removing and replacing parts accounted for 41.5% of all accidents studies. Frequently, the weight of a part was taken on at too great a distance from the body, resulting in strains, sprains, or crushed or lacerated fingers when it dropped. In most cases, removal and replacement of parts involves support equipment, but wire rope slings and chains tend to slip when they lift items by choking around them. A sudden movement can cause the sling to lose its grip and cause the part to fall free.

It is recommended that maintenance personnel be encouraged to use proper lifting equipment, or to add personnel for handling heavy parts and equipment, such as drive train, tires, and suspension. Improved job training and employee awareness of the weights and necessary handling equipment for different components and parts would help. Also, the manufacturers should emphasize possible hazards in manuals and through warning stickers placed on the equipment.

Fifteen percent of the accidents studied involved a fall from the truck frame, bumper, platform, or tire, owing to inadequate access or workstand. Portable stands are used widely in the industry, but they usually are designed for a particular maintenance task, such as changing oil filters. If a stand is used for another task, such as working on the starter, it may prove to be either too high or too low. This places the mechanic in a difficult position and increases fatigue and the possibility of an accident. A single stand with adjustable height could take the place of several stands. Stands such as this could be modeled after the racks used to drop differentials or transmissions.

Table 3 summarizes haulage truck maintenance accidents by their source i.e. the item that directly caused the injury. This information reveals that the truck body and/or large components directly inflicted about a third of the injuries. The work station, including makeshift supports, ladders, workstands, or the shop floor, was the source for 31% of the accidents.

The truck body or large components accounted for about one-third of all accidents. Two fatalities occurred in 1980 as a result of failure to secure the truck box during maintenance. In addition, numerous near-misses and many injuries occurred near medium-sized end-dump doors or tailgates. It is recommended that a definite means of securing truck boxes or tailgates be employed and that locking pins or similar devices be provided under the bed. One mine visited has fabricated a hook-and-eye system that is installed permanently on the truck.

One of the most hazardous maintenance tasks is the removal, repair, and replacement of large tires. In reviewing accident reports, it became obvious that procedures for de-airing, airing, removing, and replacing tires are inadequate. In about 12% of the accidents studied, mechanics were injured by prybars or wedge clamps, or by retaining rings damaged during previous repairs. Many mines either have purchased tire grabbing equipment, which aids in removal or replacement of tires, or improved safety by moving the tireman away from tires. Some companies have contracted outside sources for tire maintenance.

A review of tire maintenance practices indicates the following:

- Protective screens are necessary for people working on or around large tires.
- Tools used to mount and dismount tires are inadequately designed and require much physical exertion.
- The lifting devices, such as modified forklifts, are inadequate in design and in their degree of control over the tire and wheel.
- Inappropriate tools and unsafe equipment are used in the absence of proper tools.
- Lack of an effective tire damage and wear guide makes it difficult to estimate the risk of tire explosions.
- Inappropriate work practices or procedures are followed when working with a high-risk tire. Sometimes tires are brought into the shop rather than to a designated remote area.
- Often, tire maintenance personnel receive little or no formal training.

These and other factors contribute to the high risk associated with working with large tires. A number of steps have been taken by various mines to minimize these hazards. For example:

- Many mines fabricate a special cage to protect against blow-ups during inflation and deflation.
- One tire foreman devised a tire-mounting tool and had a local machine shop fabricate it. That shop now sells the unit to other mines in the area.
- Many mines have constructed special, protected areas where all tire work is completed. Should an explosion occur, workers in adjacent areas would be protected.
- One mine mounts all damaged or worn tires on the side of the truck away from the operator's station and ladders. If the tire does explode, it will be away from drivers and other passing vehicles.

Over the 2-year study period (1978 and 1979), tools and equipment were involved in about 10% of the total accidents. Table 4 lists accidents by tools and equipment. Handtools accounted for almost one-third of all injuries. Elevated platforms and servicing equipment such as jumper cables and air hoses each were involved in 15% of the accidents.

Maintenance of off-highway trucks is complex and specialized, and usually must be completed outside the realm of conventional hand and small power tools. Therefore the design of special handtools could substantially improve maintenance safety. Without knowledge about or availability of specially designed tools, shop personnel often resort to unsafe practices and procedures, locally designed and/or fabricated tools, and misuse of available tools.

The most important recommendation regarding handtools is that supervisors take more responsibility in ensuring that the right tools are used for the right job. Also, the importance of tool availability, maintenance, and proper storage again is emphasized.

Recommendations

The major factors in haulage-truck maintenance accidents appear to be as follows:

1. Lack of safety awareness or inability to measure and judge the job requirement by either the employee or the supervisor.
2. Poor access to working spaces that forces the employee to take an unsafe position.
3. Poor housekeeping.
4. Poor equipment condition.
5. Choice of the wrong tool or lack of proper tools.

The major goal of this paper has been to present truck maintenance recommendations, technically and economically feasible, that can have a high impact on safety while being acceptable to the industry. The approach has been to determine where and how maintenance personnel have been injured and to suggest how to alleviate specific hazardous situations. Many of the recommendations included in this report are practiced by those mines where top management's commitment to safety leads to excellent safety records. ●

Dennis A. Long is a mining engineer with the Twin Cities Mining Research Center, U.S. Bureau of Mines, Minneapolis, Minn.

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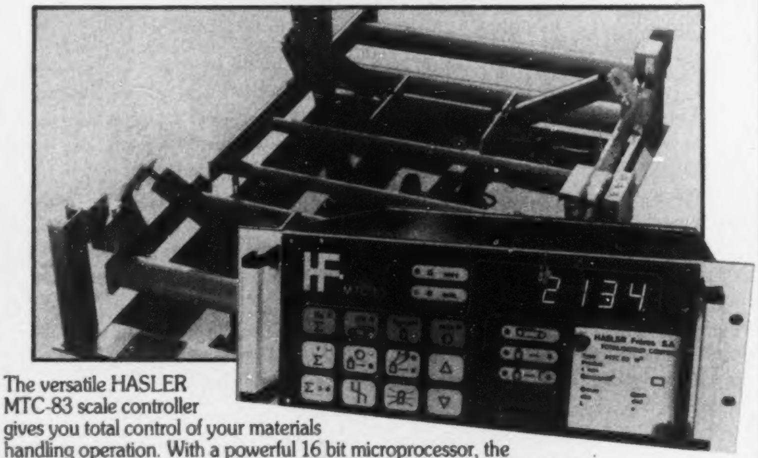

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